WENAS WILDLIFE AREA

WORK PLAN

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Prepared by

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for

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CHAPTER I. INTRODUCTION

CHAPTER I. A. Purpose for Work Plan

Implementation of the Wenas Wildlife Area Mitigation Plan will partially meet Bonneville Power Administration's (BPA) mitigation obligation to compensate for losses resulting from the construction of Grand Coulee, McNary and John Day hydroelectric dams. By funding the enhancement and reasonable operations and maintenance of the Wenas Wildlife Area (WWA) for the life of the project, BPA will receive credit towards its mitigation debt. This plan describes the background, management unit history and descriptions, management objectives, present and future landscape conditions, enhancements, operations and maintenance activities (O&M), funding requirements, Habitat Evaluation Procedure (HEP) results, and monitoring and evaluation (M&E) activities for the Wenas Wildlife Area.

CHAPTER I. B. Background

The 105,221 acre Wenas Wildlife Area, located in Yakima and Kittitas Counties, was created in 1997 by combining the Wenas and Cleman Mountain Units from the Oak Creek Wildlife Area (WA) with the South L.T. Murray Unit formerly part of the L.T. Murray Wildlife Area (Figure 1). The entire Wenas Wildlife Area lies within the Yakima Sub-basin[1] (Figure 2) and is comprised of lands owned by Washington Department of Fish and Wildlife (WDFW), Department of Natural Resources (DNR), and the Bureau of Land Management (BLM)[2] .

Washington Department of Fish and Wildlife owns 71,093 acres, leases 30,643 acres from the Department of Natural Resources, and manages 3,485 acres for the Bureau of Land Management. For the purposes of this planning document, the WWA is divided into four management units (Unit); the 31,050 acre North Cleman Mountain Unit, the 35,220 acre South Umtanum Ridge Unit, the 12,852 acre Roza Creek Unit and the 26,099 acre Umtanum Creek Unit (Figure 3).

[1] As delineated by the Northwest Power Planning Council (NPPC) in 1998.

[2] WDFW leases DNR lands and manages BLM lands through management agreements.

Figure 1. Wenas Wildlife Area general location map.

The Wenas WA provides winter range for Rocky Mountain elk (*Cervus elaphus nelsonii*) and supports Rocky Mountain mule deer (*Odocoileus hemionus hemionus*), big horn sheep (*Ovis canadensis),* sage grouse (*Centrocercus urophasianus*)[3], and a myriad of small mammals, neo-tropical/upland birds, raptors, and reptiles. Mule deer, sage grouse, western meadowlark (*Sturnella neglecta*), black-capped chickadee (*Parus atricapillus*), yellow warbler *(Dendroica petechia),* and mink *(Mustela vison)* are listed as "indicator" species in the Loss Assessments for Grand Coulee,[4] McNary[5], and John Day Dams[5] and were used to evaluate habitat conditions on the Wenas Wildlife Area during the Habitat Evaluation Procedures (HEP) analysis.

[3] Sage grouse numbers are extremely low.

[4] Wildlife Protection, Mitigation and Enhancement Planning for Grand Coulee Dam, Final Report - 1986. U.S. Department of Energy, BPA Division of Fish and Wildlife, Portland, Oregon.

[5] Wildlife Impact Assessment: Bonneville, McNary, The Dalles, and John Day Projects, October 1990. U.S. Department of Energy, BPA Division of Fish and Wildlife, Portland, Oregon.

Enhancement activities for the Wenas Wildlife Area are based on the Statewide Standards and Guidelines for Management of Lands Owned or Controlled by the Department of Fish and Wildlife (1992) (referred to as "the Guide"). The Guide is an overview of WDFW policies for managing Department lands. Adaptive management principles will be used to modify this plan as new research and/or habitat monitoring results warrant.

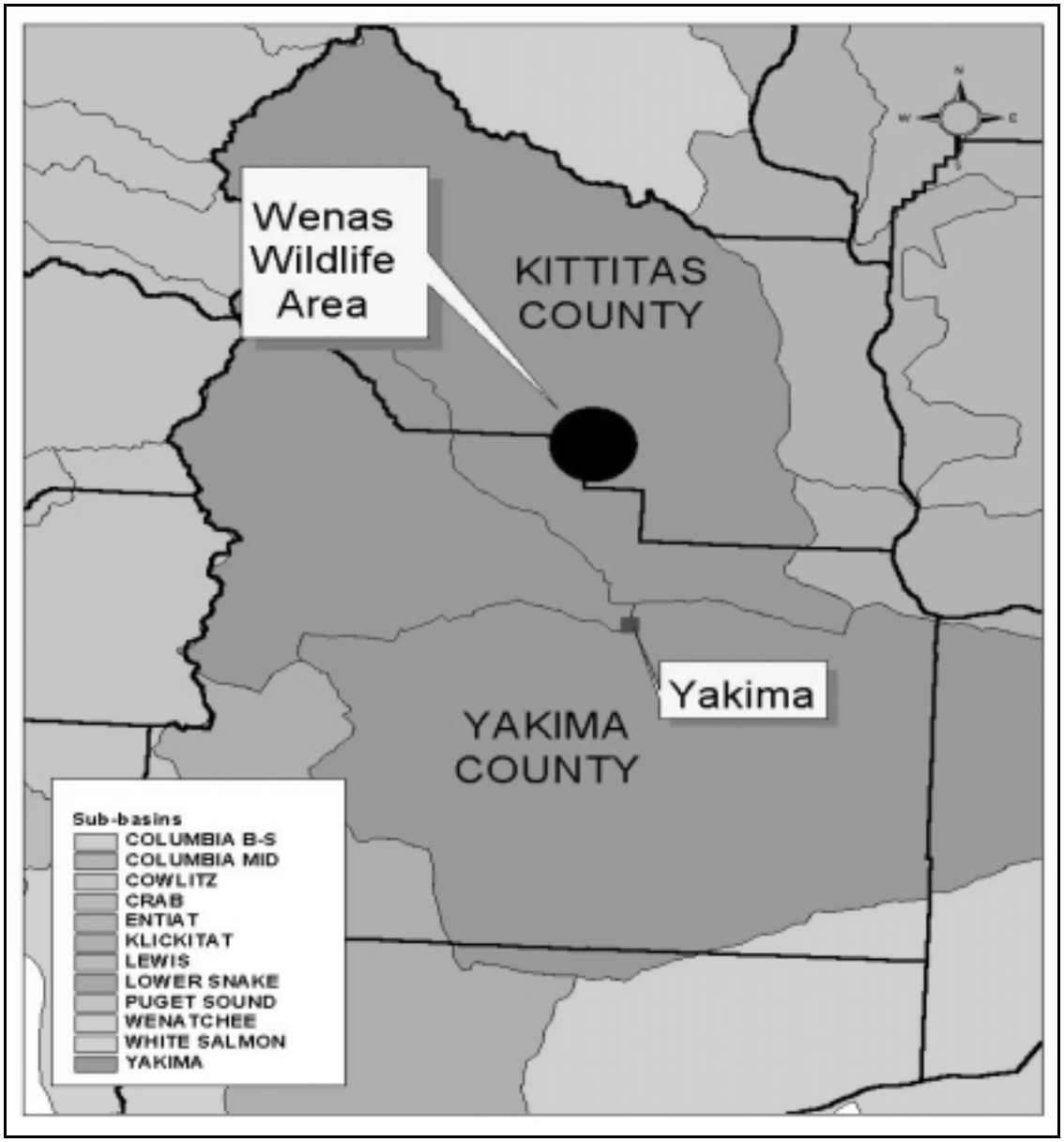


Figure 2. Wenas Wildlife Area sub-basin location map.

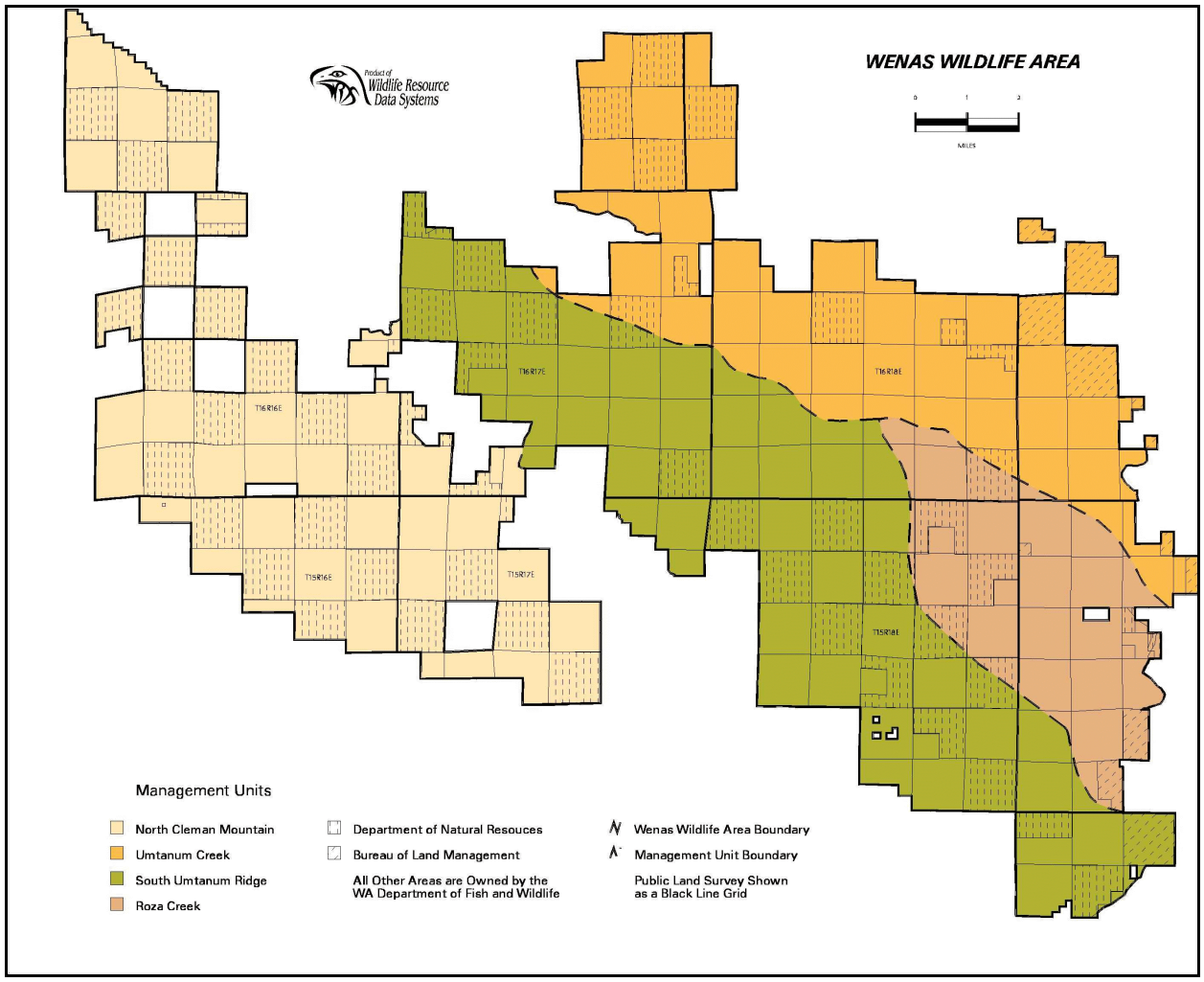


Figure 3. Wenas Wildlife Area Management Units.

This document was reviewed by WDFW Region III Ellensburg District Team members representing WDFW's Wildlife, Fisheries, Habitat and Enforcement Programs. In addition, public input was provided by the Wenas Wildlife Area Citizen Advisory Group (CAG) representing Boise Cascade Corporation, Rocky Mountain Elk Foundation, Audubon Society, hunting and equestrian interests, hikers, livestock ranchers, and local landowners.

CHAPTER I. C. Edaphic Features

The Wenas WA is located on the extreme western edge of the Columbia Plateau which gains elevation westward toward the Cascade Mountain Range. The Columbia Plateau was formed when basaltic lava erupted through fissures and covered most of central Washington. Subsequent geological activity folded this mid-Miocene Grand Ronde basalt into what are the present day mountain ridges of the Wenas WA. Wenas Creek flows along the primary syncline[6] of the area exposing Miocene volcanic sedimentary rocks, younger Wanapum basalt, ancestral Columbia River gravel and recent alluvium. Umtanum Ridge to the north is the primary anticline[7] on the WWA.

Soils of the Wenas area are very shallow to deep, well drained, and includes the Rock Creek-McDaniel stony loam association, the Cowiche-Roza loam and clay loam association, Bocker-Sutkin complex, Burke silt loam association, and the Taneum-Tieton sandy loam association. The deep, poorly-drained silt loam Umapine-Wenas association is found along the Wenas Creek flood plain.

CHAPTER I. D. Climate

The climate is typical of that on the east slope of the Cascade Range, generally hot dry summers and cold wet winters. Total precipitation in the area varies from 15 to 25 inches per year, with much of it occurring as rain and/or snow during November through March.

In winter, the average daily minimum temperatures at Yakima and Ellensburg are 23 and 20 degrees Fahrenheit respectively. The average daily maximum temperature in summer is 83 degrees Fahrenheit. Prevailing winds are from the northwest throughout most of the year.

CHAPTER II. MANAGEMENT UNIT HISTORY AND DESCRIPTIONS

CHAPTER II. A. North Cleman Mountain Unit History and Description

The 31,050 acre North Cleman Mountain Unit is comprised of the north slope of Cleman Mountain (22,633 acres), the North Fork Wenas Sub-unit (8,197 acres - comprised of lands leased from DNR and private property acquired by WDFW in1995), and the Mt. Vale Ranch (220 acres), which was

[6] A low trough-like area in bedrock, in which rocks incline together to form opposite sides.

[7] A fold with layers sloping downward on both sides from a common crest.

historically a hay farm operation and is now headquarters for the WWA (Figure 3). Boise Cascade Corporation maintains the timber rights[8] on some of the lands owned by WDFW. Timber harvest has not occurred nor is planned for parcels on which WDFW owns the timber rights. Past timber harvesting practices and relatively unrestricted vehicle use of numerous unimproved roads has resulted in establishment of major weed infestations along road right-of-ways, log landings and other disturbed soil sites throughout the Unit (these sites will be abandoned and re-vegetated in order to reduce erosion and subsequent sediment loads in streams). There is currently no livestock grazing on lands owned and/or managed by WDFW within the Cleman Mountain Unit.

The Mt. Vale Ranch, once known as the Bean Ranch in private ownership, was the headquarters for a major cattle operation. Livestock from this ranch grazed most of what is now the Wenas Wildlife Area. Historically, agricultural fields located on both sides of Wenas creek were used for hay production and/or pasture for the livestock operation. Similarly, when acquired by WDFW in the late 1960's, hay production was maintained for WDFW's winter elk feeding program until Mt Vale became the headquarters for the WWA in July of 1998. Agricultural fields (200 acres) were seeded to native grasses, forbs and shrubs in late Fall 1998. Subsequent weed control activities occurred in 1999[9]. Development of additional riparian forest habitat adjacent to Wenas Creek is planned.

Wenas Creek flows through braided channels for approximately one mile within the Cleman Mountain Unit. The fish bearing stream continues through the Wenas Valley and empties into the Yakima River thus impacting anadromous fish habitat quality within the Yakima River Basin.

CHAPTER II. B. South Umtanum Ridge Unit History and Description

The 35,221 acre South Umtanum Ridge Unit was established by combining the McCabe parcel, from the Oak Creek WA, with the Cottonwood unit formerly part of the L.T. Murray WA. Both of these areas were acquired by WDFW as part of larger land purchases in the mid to late 1960's (Figure 3).

This Unit is comprised of the south slope of Umtanum Ridge. The elevation climbs from 1,600 feet at the base of the ridge to 4,060 feet at the highest point. Intermittent streams such as Cottonwood Creek punctuate the landscape. Originating in canyons and draws, intermittent streams flow south into the Wenas Creek basin. There are also numerous perennial springs scattered throughout the Unit.

The Unit is predominately shrub-steppe vegetation. Present habitat conditions were influenced primarily by past agricultural practices, extensive livestock grazing, and fires.

[8] WDFW did not purchase the timber rights when these lands were purchased from Boise Cascade Corperation.

[9] BPA provided the funds to seed and control weeds on these former agricultural fields.

Prior to WDFW's ownership, flat sites containing better soil types were converted to agricultural fields as attempts were made to farm these fields with little to no irrigation. This Unit also had a long history of livestock grazing. One of the largest domestic sheep operations in the State was located in the Cottonwood Creek area where livestock grazing occurred throughout the entire year. Livestock winter feedlots were also prevalent.

Past uncontrolled range fires have destroyed almost all of the former ranch buildings and livestock facilities with only a couple of dilapidated hay storage pole barns remaining. Years of soil disturbance, uncontrolled vehicle use, and fires have all contributed to widespread weed infestations throughout the unit. Several enhancement and restoration projects have been implemented over the proceeding three years to improve habitat quality for endemic wildlife species.

Recent habitat restoration efforts[10] include fenced tree and shrub plantings, pond and wetland development, and conversion of abandoned agricultural fields to native like habitat. In 1998 and 1999, WDFW in conjunction with BPA, the Rocky Mountain Elk Foundation (RMEF), and the Fish and Wildlife Service (FWS) seeded native like perennial herbaceous vegetation and shrubs and controlled weeds on approximately 200 acres of abandoned cropland. In addition, removal of dilapidated fencing detrimental to wildlife was started in 1998 and will continue for several years.

Two similar projects to re-establish shrub-steppe habitat on the lower Cottonwood area[11] took place in 1998 and 1999 in cooperation with BPA and RMEF. Two abandoned agricultural fields, 500 acres and 120 acres respectively, were chemically treated for weeds, disced, fallowed, packed and seeded to native like grasses and sagebrush. Up to an additional 1,000 acres may be enhanced in the lower Cottonwood area over the next several years. Re-vegetation projects not only improve wildlife habitat, but also bring site stability as well as reduce soil erosion and weed infestations.

CHAPTER II. C. Roza Creek Unit History and Description

The 12,852 acre Roza Creek Unit encompasses the Roza Creek watershed lying between North and South Umtanum Ridges (Figure 3). Roza Creek is a small perennial, fish bearing stream which flows for approximately four miles in a southeasterly direction into the Yakima River. Bordered by steep slopes and ridges on both sides, the creek bottom supports a narrow band of riparian shrub/forest habitat throughout its length. Steep basaltic cliffs and rims rise above the Yakima River which forms the east side of the Unit. The Unit is also bordered by the South Umtanam Ridge and Umtanum Creek Units. Elevation on the Unit ranges from 1,200 feet at the Yakima River to over 3,600 feet at the top of the ridges.

[10] On the McCabe site - see Figure 10 for specific location.

[11] See Figure 9 for specific location.

Over the past thirty years wildfires have burned close to seventy-five percent of the watershed; portions of the Unit have burned more than once. As a result, much of the shrub habitat has been converted to grassland. Riparian bottoms have also burned multiple times and are currently recovering from fire disturbance. An annual contract with DNR provides for rapid air and ground response to wildfires on forest lands and adjacent areas on the WWA. This has eliminated large fires and major habitat losses for the past ten years. All other non-forest land is covered by fire contracts with county fire districts. Volunteer fire departments such as the Selah Volunteer Fire Department also provide assistance with fighting fires on the Wenas Wildlife Area.

Prior to WDFW taking ownership in 1968 and for several years thereafter[12], the Roza Creek Unit was heavily grazed. The long history of intensive year around livestock grazing resulted in extensive damage to riparian plant communities adjacent to Roza Creek. The creek bottom resembled a feed lot in appearance. With the removal of grazing, disturbed soils became infested with noxious weeds such as Russian knapweed[13]. Lacking vegetation to slow water run- off into the creek and to reduce stream velocity, Roza Creek's stream channel has incised as much as 20 feet in places. In the past three years beaver have constructed dams on the creek resulting in raising the water table, reducing water velocity, and "healing" the stream channel.

In 1998, 100 acres of knapweed at the mouth of Roza Creek was treated with herbicides applied from a helicopter. Sixty acres were then seeded with native like grasses, forbs, and shrubs in the fall of 1999. Concurrently, approximately 100 knapweed infested acres adjacent to Roza Creek were treated with herbicides from back pack and vehicle mounted spray systems. Conversion of disturbed sites to native like shrub-steppe and riparian habitat will continue for several years in partnership with the RMEF and BPA.

CHAPTER II. D. Umtanum Creek Unit History and Description

The 26,099 acre Umtanum Creek Unit, formerly managed as part of the L.T. Murray WA, encompasses approximately seventy-five percent of the entire Umtanum Creek watershed (Figure 3). Umtanum Creek[14] runs for ten miles through the Unit and empties into the Yakima River. Steep basaltic cliffs rise on both sides of the stream corridor. The narrow riparian forest zone adjacent to Umtanum Creek is comprised of ponderosa pine, Douglas fir, black cottonwood, aspen and willows.

The steep north facing slope of Umtanum ridge forms approximately one half of the unit. Elevation ranges from 1,400 feet at the Yakima River to just over 4,000 feet at the ridge summit. Past range fires have created a unique mosaic of grassland and shrubland habitats that are interspersed

[12] Grazing continued for several years under a "condition of sale" agreement.

[13] See Appendix A for scientific names of plant species.

[14] Umtanum Creek is a fish bearing stream.

throughout the north facing slope. Even though several excellent perennial springs exist on this northern exposure, water is not well dispersed over the entire Unit.

The remaining half of the Unit is very dry which is characteristic of south facing exposures in this area. Except for the cliffs along Umtanum Creek and the Yakima River, the topography is not as steep as the north half of the Unit. The majority of the area is less than 3,000 feet in elevation. The unique soil formation known as the Manastash Mounds are found through out the south half of the Unit.

Prior to WDFW ownership the Umtanum Creek Unit was used primarily for livestock grazing similar to other Units within the WWA. With the exception of riparian sites, however, grazing impacts were not as pronounced as on other Units due to the steep topography that exists on much of the area. Livestock grazing has not occurred, except for minor trespass incidents, since 1980 resulting in considerable recovery of the plant community.

In 1972, WDFW relocated eight California big horn sheep at the mouth of Umtanum Creek. Today there are close to 200 big horn sheep forming one of the largest bands in the state. The cliffs and rims along the Yakima River and Umtanum Creek provide the sheep excellent lambing/rearing habitat, ample forage, as well as security and thermal cover.

CHAPTER III. PRESENT AND FUTURE LANDSCAPE CONDITIONS

CHAPTER III. A. Background

Prior to cattle grazing and agricultural development, shrub-steppe plant communities dominated the landscape throughout much of Eastern Washington including the WWA. Livestock grazing, agricultural crop development, fire suppression, and other anthropogenic factors altered the vegetative landscape and composition of native plant communities including the introduction and/or proliferation of non-native plants. Cattle grazing, in particular, has impacted shrub-steppe, grassland, riparian, and wetland vegetation habitat quality throughout the Wenas WA.

WDFW conducted a Habitat Evaluation Procedure analysis from 1997 through 1999 to assess habitat quality, relative to HEP wildlife species models[15], and to evaluate extant vegetation. Development of the WWA habitat cover type map was an integral part of this process. The size of the WWA, complexity of the plant community/juxtaposition of cover types over the landscape, along with temporal and funding limitations required a unique approach to developing the cover type map. This process is described in the following paragraphs.

[15] Review HEP section for further details.

Information used to complete the cover typing included field sampled vegetation data, digital soils data provided by the Natural Resources Conservation Service (NRCS), and aerial photographs. Soils data exists for approximately 80 percent of the WWA. Soil texture, depth, and other characteristics are used by the NRCS to predict plant communities likely present on a particular soil type. Throughout this process, habitat information collected from 67 field transects was used to improve and/or verify accuracy of cover type classifications. Information from "ground truthing" aerial photo data was correlated with NRCS data to develop the final map product.

Plant communities based on NRCS soils data were compared to habitat cover types to produce the first draft of the Wenas habitat cover type map. For example, if NRCS data indicated a soil type for a specific area supported sagebrush, WDFW biologists examined aerial photographs and transect data to confirm the presence/absence of sagebrush. Where soils data was unavailable, a biologist familiar with the area interpreted aerial photographs to map habitat cover types. Photo interpretation/ground truthing was also used to correct any mis-classifications generated from the soils data.

Due to the complexity of delineating separate cover type polygons for grasslands and vegetation occurring on Lithisol(s) soils[16], grasslands and areas of Lithosol(s) soils were grouped together regardless of the amount of shrub cover. Likewise, the shrubland cover type is comprised of all acreage with shrub cover equal to/or exceeding 15 percent (excluding shrubs occurring on Lithisol(s) soils and acreage with a timber overstory - included in conifer forest). Forest cover types are divided into three types: forested woodland, medium conifer, and dense conifer. Riparian cover types include riparian forest, riparian shrub and riverine (Figure 4). Cover types are defined on Table 1.

[16] Lithisol(s) soils are shallow and rocky and have a shrub component usually less than 10 percent cover. Shrub cover may occasionally exceed 15 percent cover in some areas. The cover function on these areas is closer to grasslands than to shrublands.

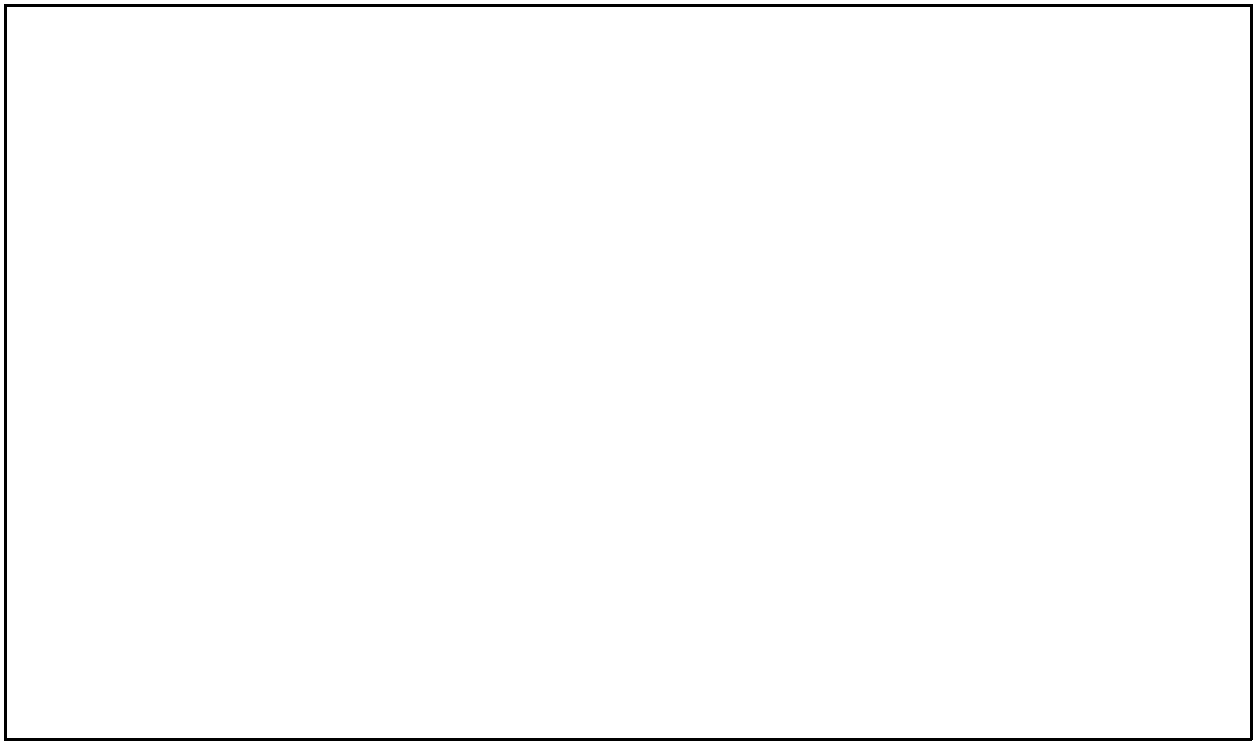


Figure 4. Wenas Wildlife Area cover type, ownership, and HEP transect map.[17]

[17] A larger scale map is included in Attachment 1.

Table 1. Wenas Wildlife Area Cover type descriptions.

COVER TYPE	DESCRIPTION
Grassland	Herbaceous grass and forbs with a shrub component less than 15 percent cover. Includes shallow Lithisols soils.
Shrubland	Shrub cover is 15 percent or greater without a timber over-story and does not include the Lithisol(s) soil types.
Riparian Shrub	A diverse mix of shrubs in close proximity to water (generally wetland obligate and facultative species) that may include some trees. Shrubs are the dominant feature.
Riparian Forest	A conifer and/or deciduous forest within a riparian zone (may include a shrub understory). Trees are the dominant feature.
Riverine	Habitat within the high water mark of a river corridor.
Conifer Woodland	The tree canopy closure is less than 45 percent.
Medium Conifer Forest	The tree canopy closure is from 46 to 70 percent.
Dense Conifer Forest	The tree canopy closure is 71 to 100 percent.
Re-vegetated fields/ grasslands	Former agricultural fields or grasslands planted to native like grasses, forbs and/or shrubs.

Due to the complex interspersed nature of the shrubgrass[18] and dense shrubland[19] sub-cover types and the time/expense required to delineate these sub-cover types at a meaningful resolution, HEP evaluators did not cover type map shrubgrass and dense shrubland separately, but included both within the shrubland cover type for mapping purposes. Transect results and summary tables for shrubgrass and dense shrubland cover types, however, are described separately in this document in order to adequately describe habitat variability on all Management Units.

In contrast, forest habitats are cover typed separately while tree canopy data is generalized. Herbaceous and shrub stratums within the forest cover type are described based on the following categories: shrubgrass, shrubland, and dense shrubland. Specific transect locations are shown on Figure 4 while individual transect data summary sheets are included in Attachment 1.

[18] Shrub cover values range from 5 percent to less than 15 percent.

[19] Shrub cover exceeds 25 percent.

CHAPTER III. B. North Cleman Mountain Unit Present/Future Landscape Conditions

Present Landscape Conditions: The 31,050 acre North Cleman Mountain Unit is comprised of the following seven cover types: grassland, shrubland, riparian forest, conifer woodland, medium conifer forest, dense conifer forest and re-vegetated fields (Figure 4). Cover types and acreage figures are listed in Table 2.

Table 2. North Cleman Mountain Unit cover types and acreage.

COVER TYPE	ACRES
Grassland	12,475
Shrubland	2,480
Riparian Forest	874
Conifer Forest-Woodland	8,619
Conifer Forest-Medium	4,294
Conifer Forest-Dense	2,110
Re-vegetated fields/grasslands	198
TOTAL	31,050

The following paragraphs describe present habitat conditions by cover type on the North Cleman Mountain Unit. The information is derived from data collected during the HEP analysis except where noted.

Grassland

Predominant perennial grass species include Sandberg bluegrass, Idaho fescue and bluebunch wheatgrass. Forbs such as buckwheat[20], phlox, and fleabane are also present. Exotic species[21] (cheatgrass and annual forbs) are widely dispersed throughout the cover type, but comprise less than three percent relative cover (all comparisons are based on percent relative cover). Frequency[22],

[20] Buckwheat was considered a forb on HEP transects.

[21] Exotic species refer to non-native plant species and are generally considered to be weeds.

[22] The percent of micro plot grids a species occurred in. For example, if ten micro plots were evaluated and a particular species occurred in five of the plots, frequency is 50 percent.

percent cover, constancy[23], and relative cover data for this cover type is described in detail on Tables 3 and 4.

Shrubgrass

The predominant grass species found in the shrubgrass cover type are bluebunch wheatgrass, Sandberg bluegrass, and Idaho fescue. Forb composition includes primarily phlox and yarrow. Green rabbitbrush, gray rabbitbrush, and three-tip sagebrush are also present. Annual forbs and other exotic species comprise almost 30 percent of the total herbaceous cover. Specific transect results are listed on Tables 5 and 6.

Shrubland

Shrub species composition and/or percent cover varies as elevation, slope and aspect change. Three-tip sagebrush, and bitterbrush are the co-dominant shrub species followed by green rabbitbrush, mountain sagebrush, gray rabbitbrush, snowberry, bittercherry, and big sagebrush. Bluebunch wheatgrass, Sandberg bluegrass, and Idaho fescue dominate the grass stratum while buckwheat, phlox and yarrow are representative of the forb component. Cheatgrass, annual forbs and other exotic species constitute 38 percent of all herbaceous cover (Tables 7 and 8).

Dense Shrubland

Bitterbrush dominates the landscape in this cover type. Green and gray rabbitbrush as well as wax currant can also be found interspersed throughout the bitterbrush stands. Examples of herbaceous cover include Sandberg bluegrass, bluebunch wheatgrass, Idaho fescue, yarrow, arrowleaf balsomroot and other undifferentiated forb species. Exotic species are widespread and comprise 71 percent of the total herbacous cover (Tables 9 and 10).

Riparian Forest

The riparian forest cover type, located primarily within forested draws, is composed of a diverse mix of conifer and deciduous tree and shrub species. Douglas fir and ponderosa pine are the predominant conifers while black cottonwood and quaking aspen make up the deciduous tree component. The shrub layer is dominated by snowberry, ocean spray, Douglas maple, and red-osier dogwood. Numerous other shrub species such as currant, mock-orange, rose, thimbleberry, white alder, and spirea are also present. Pinegrass, elk sedge, false Solomon's seal, baneberry, and arnica comprise most of the herbaceous stratum while weedy species contribute less than one percent towards the total amount of herbaceous cover (Tables 11, 12, and 13).

Conifer Forest

Conifer forest is the largest cover type in this Unit. Ponderosa pine and Douglas fir are the dominant tree species throughout the cover type. Western larch and grand fir are also present at the highest elevations. The shrub stratum generally consists of multiple species including wax currant,

[23] The percent of transects a species occurred. For example, if four transects were evaluated and a particular species was present on two of the transects, constancy is 50 percent.

snowberry, bitterbrush, ceanothus, snowberry, Oregon grape, gray rabbitbrush, serviceberry, and Douglas maple. Predominant perennial grass species include pine grass, elk sedge, and Idaho fescue followed by bluebunch wheatgrass, bottlebrush squirreltail, and undifferentiated bluegrass species. Similarly, numerous forbs such as heartleaf arnica, lupine, and yarrow are also present. Cheatgrass, annual forbs, and other weeds comprise approximately four percent of the relative herbaceous cover. Shrub and herbaceous cover data for the forest cover type is listed on Tables 14 through 21 (Table data is explained in Figures 5 and 6).

Re-vegetated Fields/Grassland

Alfalfa fields that were seeded to native grasses, forbs and big sagebrush in 1998. Enhancement efforts will continue on this site until a diverse shrubland habitat type is established.

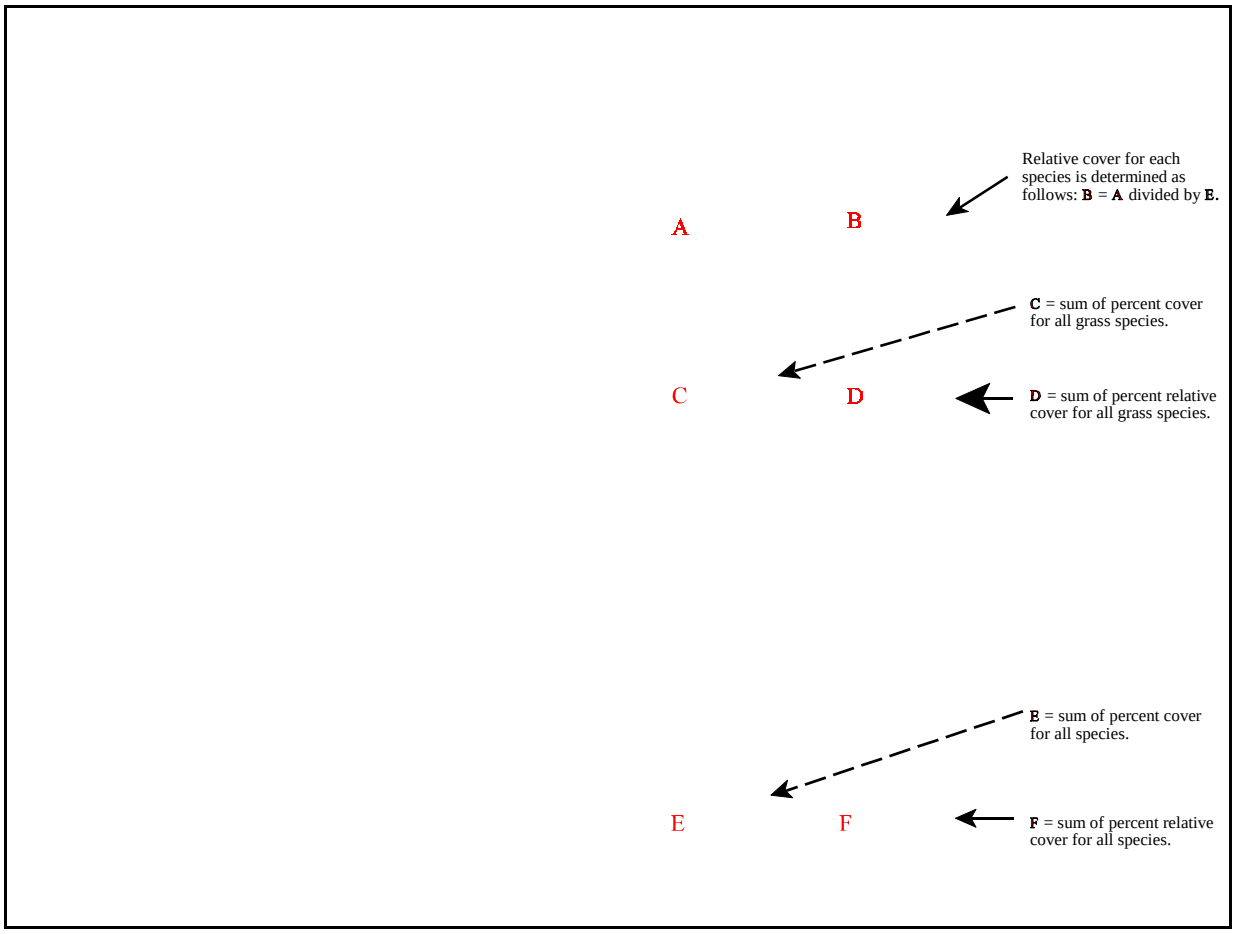


Figure 5. Herbaceous cover data explanation.

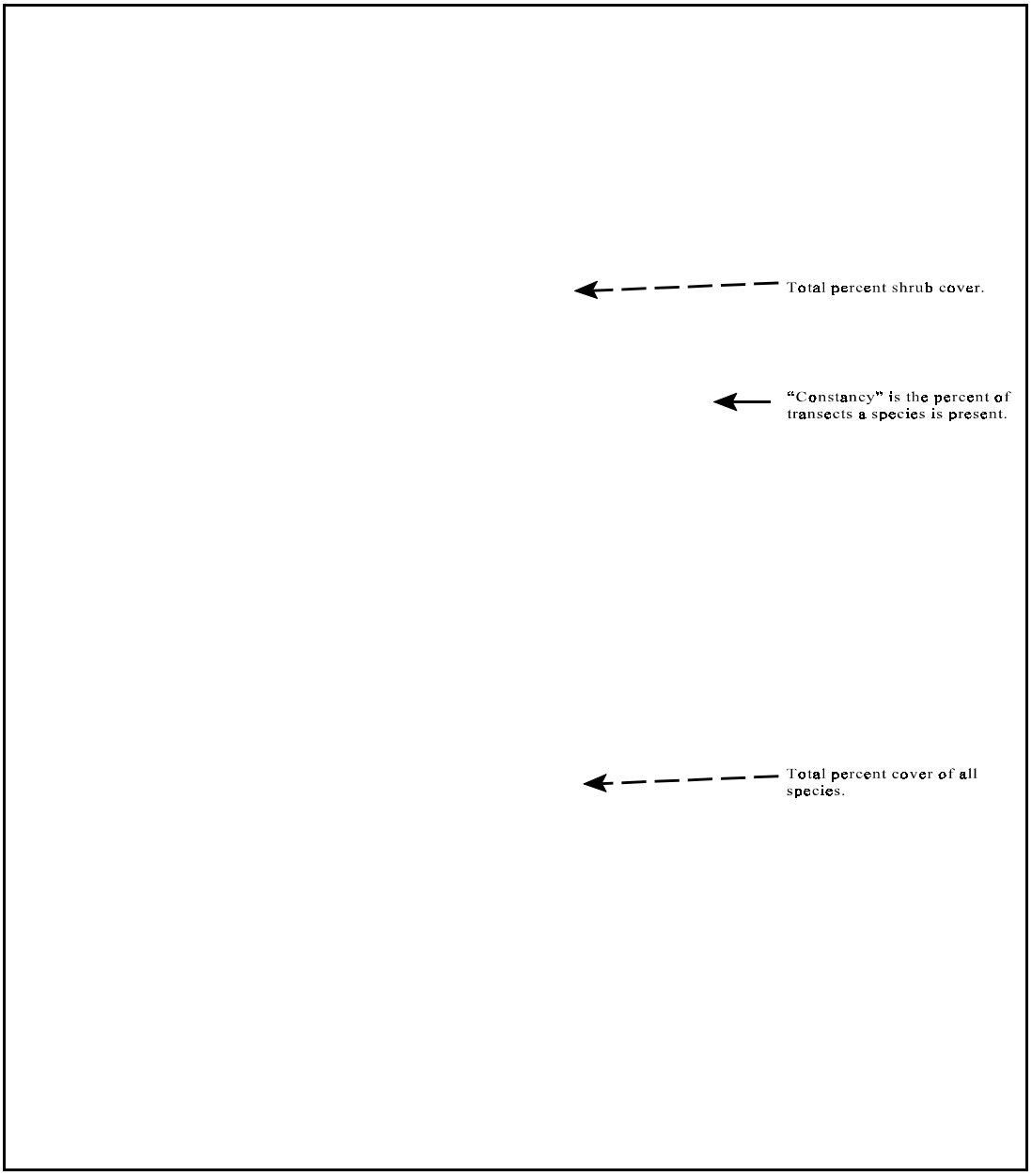


Figure 6. Table data explanation for percent cover and constancy.

Table 3. Mean percent frequency, cover, and relative cover of herbaceous vegetation in the grassland cover type (transect 106).

Stratum	Species	Frequency	Cover	Relative Cover
		- - - - - - - P e r c e n t - - - - - - -		
Grasses	Sandberg bluegrass	95.00	14.13	31.06
	Bluebunch wheatgrass	25.00	2.93	6.44
	Idaho fescue	52.50	8.55	18.80
	Other grasses	42.50	0.53	1.17
subtotal			**(26.14)**	**(57.46)**
Forbs	Buckwheat	72.50	9.28	20.40
	Fleabane	10.00	0.85	1.28
	Phlox	70.00	4.70	10.33
	Violet	95.00	2.08	4.57
	Other forbs	82.50	1.53	3.36
subtotal			**(18.17)**	**(39.94)**
Exotic spp.	Annual forbs	97.50	1.18	2.59
subtotal			**(1.18)**	**(2.59)**
TOTAL			**(45.49)**	**(100.00)**

Table 4. Comparison of mean percent canopy cover and constancy for the grassland cover type (transect 106).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Stiff sagebrush	1.82	100.00
	Mountain sagebrush	7.70	100.00
subtotal		**(9.52)**	
Grasses	Sandberg bluegrass	14.13	100.00
	Bluebunch wheatgrass	2.93	100.00
	Idaho fescue	8.55	100.00
	Other grasses	0.53	100.00
subtotal		**(26.14)**	
Forbs	Buckwheat	9.28	100.00
	Fleabane	0.58	100.00
	Phlox	4.70	100.00
	Violet	2.08	100.00
	Other forbs	1.53	100.00
subtotal		**(18.17)**	
Exotic spp.	Annual forbs	1.18	100.00
subtotal		**(1.18)**	
TOTAL COVER		**(55.01)**	

Table 5. Mean percent frequency, cover, and relative cover of herbaceous vegetation for the shrubgrass cover type (transect 119).

Stratum	Species	Frequency	Cover	Relative Cover
		- - - - - - - P e r c e n t - - - - - - -		
Grasses	Sandberg bluegrass	100.00	19.90	19.95
	Bluebunch wheatgrass	95.00	29.80	29.87
	Idaho fescue	30.00	4.45	4.46
subtotal			**(54.15)**	**(54.29)**
Forbs	Phlox	50.00	5.80	5.81
	Yarrow	40.00	4.70	4.71
	Other forbs	55.00	5.55	5.56
subtotal			**(16.05)**	**(16.09)**
Exotic spp.	Annual forbs	90.00	9.90	9.92
	Other exotics	50.00	19.65	19.70
subtotal			**(29.55)**	**(29.62)**
TOTAL			**(99.75)**	**(100.00)**

Table 6. Comparison of mean percent canopy cover and constancy for the shrubgrass cover type (transect 119).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Threetip sagebrush	1.39	100.00
	Gray rabbitbrush	1.77	100.00
	Green rabbitbrush	7.47	100.00
subtotal		**(10.63)**	
Grasses	Sandberg bluegrass	19.90	100.00
	Bluebunch wheatgrass	29.80	100.00
	Idaho fescue	4.45	100.00
subtotal		**(54.15)**	
Forbs	Phlox	5.80	100.00
	Yarrow	4.70	100.00
	Other forbs	5.55	100.00
subtotal		**(16.05)**	
Exotic spp.	Annual forbs	9.90	100.00
	Other exotics	19.65	100.00
subtotal		**(29.55)**	
TOTAL COVER		**(110.38)**	

Table 7. Mean percent frequency, cover, and relative cover of herbaceous vegetation in the shrubland cover type (transects 104, 116, 118).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Sandberg bluegrass	81.67	8.23	12.45
	Bluebunch wheatgrass	53.33	16.40	24.80
	Bottlebrush squirreltail	13.33	0.27	0.40
	Idaho fescue	45.00	1.65	2.50
	Bulbous bluegrass	5.00	0.28	0.42
	Henderson ricegrass	5.00	0.07	0.10
	Needlegrass	1.67	0.02	0.03
subtotal			**(26.91)**	**(40.71)**
Forbs	Arrowleaf balsamroot	3.33	0.08	0.13
	Yarrow	10.00	0.56	0.85
	Fleabane	1.67	0.03	0.05
	Buckwheat	51.66	8.18	12.38
	Phlox	26.67	1.70	2.57
	Other forbs	40.00	3.37	5.09
subtotal			**(13.93)**	**(21.06)**
Exotic spp.	Cheatgrass	6.67	0.40	0.60
	Annual forbs	61.67	4.38	6.63
	Other exotics	60.00	20.49	31.00
subtotal			**(25.28)**	**(38.23)**
TOTAL			**(66.12)**	**(100.00)**

Table 8. Comparison of mean percent canopy cover and constancy for the shrubland cover type (transects 104, 116, 118).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Stiff sagebrush	0.29	33.33
	Green rabbitbrush	1.46	66.66
	Three-tip sagebrush	4.57	66.66
	Bitterbrush	4.44	66.66
	Gray rabbitbrush	0.91	66.66
	Big sagebrush	0.25	33.33
	Mountain sagebrush	1.12	33.33
	Snowberry	0.51	33.33
	Bitter cherry	0.33	33.33
subtotal		**(13.88)**	
Grasses	Sandberg bluegrass	8.23	100.00
	Bluebunch wheatgrass	16.40	100.00
	Bottlebrush squirreltail	0.27	33.33
	Idaho fescue	1.65	100.00
	Bulbous bluegrass	0.28	33.33
	Henderson ricegrass	0.07	33.33
	Needlegrass	0.02	33.33
subtotal		**(26.91)**	
Forbs	Arrowleaf balsamroot	0.08	33.33
	Yarrow	0.56	33.33
	Fleabane	0.03	33.33
	Buckwheat	8.18	100.00
	Phlox	1.70	66.66
	Other forbs	3.37	66.66
subtotal		**(13.93)**	
Exotic spp.	Cheatgrass	0.40	33.33
	Annual forbs	4.38	66.66
	Other exotics	20.49	66.66
subtotal		**(25.28)**	

TOTAL COVER	**(79.99)**	

Table 9. Mean percent frequency, cover, and relative cover of herbaceous vegetation within the dense shrub cover type (transect 117).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Sandberg bluegrass	75.00	10.70	9.52
	Bluebunch wheatgrass	35.00	7.20	6.41
	Idaho fescue	15.00	3.40	3.02
	Bulbous bluegrass	15.00	0.95	0.85
	Needlegrass	20.00	3.10	2.76
subtotal			**(25.35)**	**(22.55)**
Forbs	Arrowleaf balsamroot	5.00	0.35	0.31
	Yarrow	50.00	3.00	2.67
	Other forbs	35.00	3.60	3.20
subtotal			**(6.95)**	**(6.18)**
Exotic spp.	Annual forbs	75.00	21.50	19.13
	Other exotics	95.00	58.60	52.14
subtotal			**(80.10)**	**(71.26)**
TOTAL			**(112.40)**	**(100.00)**

Table 10. Comparison of mean percent canopy cover and constancy for the dense shrub cover type (transect 117).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Gray rabbitbrush	1.44	100.00
	Green rabbitbrush	2.79	100.00
	Bitterbrush	41.22	100.00
	Squaw currant	2.76	100.00
subtotal		**(48.21)**	
Grasses	Sandberg bluegrass	10.70	100.00
	Bluebunch wheatgrass	7.20	100.00
	Idaho fescue	3.40	100.00
	Bulbous bluegrass	0.95	100.00
	Needlegrass	3.10	100.00
subtotal		**(25.35)**	
Forbs	Arrowleaf balsamroot	0.35	100.00
	Yarrow	3.00	100.00
	Other forbs	3.60	100.00
subtotal		**(6.95)**	
Exotic spp.	Annual forbs	21.50	100.00
	Other exotics	58.60	100.00
subtotal		**(80.10)**	
TOTAL COVER		**(160.61)**	

Table 11. Mean percent frequency, cover, and relative cover of herbaceous vegetation within the riparian forest cover type (transects 102, 110, 111, 115).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Sedge	1.25	0.31	1.28
	Bluebunch wheatgrass	2.08	0.42	1.70
	Bluegrass	2.50	0.26	1.05
	Pinegrass	7.50	4.69	19.13
	Elk sedge	8.33	2.15	8.75
	Other grasses	17.50	5.55	22.65
subtotal			**(13.37)**	**(54.57)**
Forbs	Clematis	4.17	0.83	3.40
	Fleabane	3.33	0.34	1.38
	False solomon's seal	25.00	3.10	12.68
	Baneberry	6.25	0.88	3.57
	Larkspur	1.25	0.25	1.02
	Heartleaf arnica	16.25	0.65	2.65
	Other forbs	27.50	5.03	20.51
subtotal			**(11.07)**	**(45.18)**
Exotic spp.	Annual forbs	4.17	0.06	0.26
subtotal			**(0.06)**	**(0.26)**
TOTAL			**(24.50)**	**(100.00)**

Table 12. Comparison of mean percent canopy cover and constancy for shrubs within the riparian forest cover type (transects 102, 110, 111,115).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Douglas maple	12.25	100.00
	White alder	1.29	25.00
	Sitka alder	0.19	25.00
	Serviceberry	0.83	25.00
	Oregon grape	0.18	50.00
	Clematis	0.35	25.00
	Red-oiser dogwood	6.71	75.00
	Oceanspray	14.82	100.00
	Mockorange	9.59	50.00
	Quaking aspen	0.49	25.00
	Bittercherry	0.41	25.00
	Chokecherry	0.60	25.00
	Currant	2.06	75.00
	Squaw currant	0.04	25.00
	Rose	2.22	100.00
	Thimbleberry	1.97	50.00
	Willow	1.77	75.00
	White spirea	0.22	25.00
	Spirea	1.28	50.00
	Snowberry	17.76	100.00
Total		**(75.02)**	

Table 13. Comparison of mean percent canopy cover and constancy of herbaceous vegetation within the riparian forest cover type (transects 102, 110, 111, 115).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Grasses	Sedge	0.31	25.00
	Bluebunch wheatgrass	0.42	25.00
	Bluegrass	0.26	25.00
	Pinegrass	5.55	75.00
	Elk sedge	4.69	50.00
	Other grasses	2.15	25.00
subtotal		**(13.37)**	
Forbs	Clematis	0.83	25.00
	Fleabane	0.34	50.00
	False Solomon's seal	3.10	50.00
	Baneberry	0.88	25.00
	Larkspur	0.25	25.00
	Heartleaf arnica	0.65	75.00
	Other forbs	5.03	50.00
subtotal		**(11.07)**	
Exotic spp.	Annual forbs	0.06	
subtotal		**(0.06)**	
TOTAL COVER		**(24.50)**	

Table 14. Mean percent frequency, cover, and relative cover of herbaceous vegetation (shrubgrass) within the conifer forest cover type (transects 113 and 121).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Bluebunch wheatgrass	6.25	2.06	2.68
	Elk sedge	28.75	5.58	7.25
	Pinegrass	56.25	30.13	39.16
	Idaho fescue	3.75	0.86	1.12
	Bluegrass	10.00	1.12	1.46
	Bottlebrush squirreltail	10.00	0.96	1.25
	Other grasses	51.25	10.73	13.95
subtotal			**(51.44)**	**(66.86)**
Forbs	Yarrow	55.00	2.82	3.67
	Fleabane	10.00	1.00	1.30
	Heartleaf arnica	17.50	4.64	6.03
	Lupine	3.75	0.35	0.45
	Peavine	31.25	5.45	7.08
	Other forbs	65.00	8.76	11.39
subtotal			**(23.02)**	**(29.92)**
Exotic spp.	Cheatgrass	1.25	0.02	0.03
	Annual forbs	47.50	2.46	3.20
subtotal			**(2.48)**	**(3.22)**
TOTAL			**(76.94)**	**(100.00)**

Table 15. Mean percent canopy cover and constancy of a shrubgrass understory within the conifer forest cover type (Transects 113 and 121).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Low sagebrush	0.34	50.00
	Green rabbitbrush	0.57	50.00
	Squaw currant	1.86	100.00
	Blue elderberry	0.03	50.00
	Snowberry	6.07	100.00
	Kinnikinnick	0.20	50.00
	Oregon grape	0.43	50.00
	Blackcap	0.08	50.00
	Birch leaved spirea	0.26	50.00
	Oceanspray	0.45	50.00
subtotal		**(10.29)**	50.00
Grasses	Bluebunch wheatgrass	2.06	100.00
	Elk sedge	5.58	100.00
	Pinegrass	30.13	100.00
	Idaho fescue	0.86	50.00
	Bluegrass	1.12	50.00
	Bottlebrush squirreltail	0.96	100.00
	Other grasses	10.73	100.00
subtotal		**(51.44)**	
Forbs	Yarrow	2.82	100.00
	Fleabane	1.00	50.00
	Heartleaf arnica	4.46	50.00
	Lupine	0.35	50.00
	Peavine	5.45	50.00
	Other forbs	8.76	100.00
subtotal		**(23.02)**	
Exotic spp.	Cheatgrass	0.02	50.00
	Annual forbs	2.46	100.00
subtotal		**(2.48)**	
TOTAL COVER		**(87.23)**	

Table 16. Mean percent frequency, cover, and relative cover of herbaceous vegetation (shrubland) within the conifer forest cover type (transect 101).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Reedgrass	40.00	0.95	1.41
	Sedge	57.50	6.80	10.18
	Pinegrass	42.50	24.96	37.00
	Idaho fescue	5.00	1.75	2.59
	Bluegrass	10.00	0.16	0.24
	Bottlebrush squirreltail	12.50	0.36	0.53
	Other grasses	5.00	1.00	1.48
subtotal			(35.98)	(53.34)
Forbs	Yarrow	37.50	1.40	2.08
	Heartleaf arnica	80.00	17.04	25.26
	Arrowleaf balsamroot	2.50	0.50	0.75
	Lupine	72.50	4.34	6.43
	Other forbs	80.00	6.20	9.19
subtotal			(29.48)	(43.70)
Exotic spp.	Cheatgrass	5.00	2.00	2.96
subtotal			(2.00)	(2.96)
TOTAL			(67.46)	(100.00)

Table 17. Comparison of mean percent canopy cover and constancy of a shrubland understory within the conifer forest cover type (transect 101).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Serviceberry	0.02	100.00
	Oregon grape	0.06	100.00
	Snowbrush ceanothus	0.13	100.00
	Ponderosa pine	4.56	100.00
	Douglas fir	4.88	100.00
	Golden currant	0.88	100.00
	Rose	0.19	100.00
	Douglas spirea	8.71	100.00
	Snowberry	1.68	100.00
	Huckleberry	0.03	100.00
subtotal		**(21.14)**	
Grasses	Reedgrass	0.95	100.00
	Sedge	6.80	100.00
	Pinegrass	24.96	100.00
	Idaho fescue	1.75	100.00
	Bluegrass	0.16	100.00
	Bottlebrush squirreltail	0.36	100.00
	Other grasses	1.00	100.00
subtotal		**(35.98)**	
Forbs	Yarrow	1.40	100.00
	Heartleaf arnica	17.04	100.00
	Arrowleaf balsamroot	0.50	100.00
	Lupine	4.34	100.00
	Other forbs	6.20	100.00
subtotal		**(29.48)**	
Exotic spp.	Cheatgrass	2.00	100.00
subtotal		**(2.00)**	
TOTAL COVER		**(88.60)**	

Table 18. Mean percent frequency, cover, and relative cover of herbaceous vegetation (dense shrub) within the conifer forest cover type (transects 114 and 120).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Bluebunch wheatgrass	38.75	12.02	20.11
	Brome	5.00	0.83	1.39
	Elk sedge	38.75	11.39	19.06
	Pinegrass	23.75	13.13	21.97
	Bluegrass	5.00	0.60	1.00
	Bottlebrush squirreltail	5.00	0.13	0.22
	Other grasses	40.00	5.09	8.52
subtotal			**(43.19)**	**(72.26)**
Forbs	Yarrow	45.00	2.90	4.85
	Fleabane	2.50	0.63	1.05
	Buckwheat	10.00	1.39	2.33
	Peavine	6.25	0.33	0.55
	Other forbs	71.25	7.63	12.77
subtotal			**(12.88)**	**(21.55)**
Exotic spp.	Cheatgrass	42.65	2.10	3.51
	Annual forbs	25.00	1.60	2.68
subtotal			**(3.70)**	**(6.19)**
TOTAL			**(59.77)**	**(100.00)**

Table 19. Mean percent canopy cover and constancy for a dense shrub understory within the conifer forest cover type (Transects 114, 120).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Douglas maple	0.80	50.00
	Serviceberry	0.76	100.00
	Kinnikinnick	1.31	50.00
	Oregon grape	1.16	100.00
	Snowbrush ceanothus	8.17	50.00
	Gray rabbitbrush	0.16	50.00
	Mountain boxwood	0.54	50.00
	Bitterbrush	10.47	50.00
	Squaw currant	1.77	100.00
	Birch leaved spirea	3.75	50.00
	Snowberry	1.83	100.00
subtotal		**(30.72)**	
Grasses	Bluebunch wheatgrass	12.02	100.00
	Brome	0.83	50.00
	Elk sedge	11.39	100.00
	Pinegrass	13.13	100.00
	Bluegrass	0.60	50.00
	Bottlebrush squirreltail	0.13	50.00
	Other grasses	5.09	50.00
subtotal		**(43.19)**	
Forbs	Yarrow	2.90	100.00
	Fleabane	0.63	50.00
	Buckwheat	1.39	50.00
	Peavine	0.33	50.00
	Other forbs	7.63	100.00
subtotal		**(12.88)**	
Exotic spp.	Cheatgrass	2.10	50.00
	Annual forbs	1.60	100.00
subtotal		**(3.70)**	

TOTAL COVER	**(90.49)**	

Table 20. Mean percent frequency, cover, and relative cover of a grassland understory within the conifer forest cover type (Transects 103, 105, 112).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Bluebunch wheatgrass	14.17	1.52	3.69
	Pinegrass	39.17	9.05	21.96
	Elk sedge	16.67	3.84	9.32
	Sedge	10.83	2.89	7.01
	Idaho Fescue	10.00	2.63	6.38
	Fescue	20.00	2.32	5.63
	Bluegrass	11.67	1.29	3.13
	Other grasses	45.00	4.80	11.65
subtotal			**(28.34)**	**(68.77)**
Forbs	Arrowleaf balsamroot	4.17	0.35	0.85
	Buckwheat	0.83	0.12	0.29
	Fleabane	7.50	.035	0.85
	Heartleaf arnica	11.67	2.83	6.87
	Lupine	21.67	1.18	2.86
	Peavine	5.00	0.38	0.92
	Phlox	1.67	0.03	0.07
	Vetch	10.00	0.49	1.19
	Yarrow	23.33	0.99	2.40
	Other forbs	47.50	4.45	10.80
subtotal			**(11.17)**	**(27.11)**
Exotic spp.	Cheatgrass	9.16	0.71	1.72
	Annual forbs	17.50	0.99	2.40
subtotal			**(1.70)**	**(4.13)**

TOTAL	**(41.21)**	**(100.00)**

Table 21. Mean percent canopy cover and constancy of a grassland understory within the conifer forest cover type (Transects 103, 105, 112).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Bittercherry	0.10	33.33
	Honeysuckle	0.01	33.33
	Mountain sagebrush	0.03	66.66
	Oregon grape	0.20	33.33
	Rose	0.07	100.00
	Serviceberry	0.15	66.66
	Snowberry	0.05	33.33
	Snowbrush ceanothus	0.03	33.33
	Douglas spirea	0.06	33.33
	Squaw currant	0.03	66.66
subtotal		(0.73)	
Grasses	Bluebunch wheatgrass	1.52	33.33
	Pinegrass	9.05	100.00
	Elk sedge	3.84	33.33
	Sedge	2.89	66.66
	Idaho fescue	2.63	33.33
	Fescue	2.32	66.66
	Other grasses	5.09	66.66
subtotal		(28.34)	
Forbs	Arrowleaf balsamroot	0.35	66.66
	Fleabane	0.35	33.33
	Heartleaf arnica	2.83	33.33
	Lupine	1.18	66.66
	Peavine	0.38	33.33
	Vetch	0.52	66.66
	Yarrow	0.99	100.00
	Other forbs	4.57	66.66
subtotal		(11.17)	
Exotic spp.	Cheatgrass	0.71	66.66
	Annual forbs	0.99	33.33

subtotal		(1.70)	
TOTAL COVER		(41.94)	

Future Landscape Conditions: Enhancement activities are designed to reduce the density and distribution of introduced weed species such as knapweed, thistles, and cheatgrass. The infestations are primarily located adjacent to roads and on disturbed sites associated with past livestock grazing and timber harvest activities. These sites will be restored to a more native like condition by aggressively controlling weeds and seeding herbaceous cover as required. Deciduous tree (primarily cottonwood and aspen) vigor, age structure, and density will be improved within the riparian forest cover type. Alfalfa fields at the Mt Vale Ranch will be converted to shrubland habitat.

CHAPTER III. C. South Umtanum Ridge Unit Present/Future Landscape Conditions

Present Landscape Conditions: The 35,221 acre South Umtanum Ridge Unit is comprised of the following seven cover types: grassland, shrubland, riparian shrub, conifer forest woodland, conifer forest-medium, riverine and re-vegetated fields/grasslands (Figure 4). Cover types and acreage figures are described on Table 22.

Table 22. South Umtanum Ridge Unit cover types and acreage.

COVER TYPE	ACRES
Grassland	28,328
Shrubland	5,132
Riparian Shrub	171
Conifer Forest-Woodland	571
Conifer Forest-Medium	115
Riverine	33
Re-vegetated fields/grasslands	870
TOTAL	35,220

The following paragraphs describe present habitat conditions by cover type on the South Umtanum Ridge Unit (SUR). The information is derived from data collected during the HEP analysis except where noted. The shrubgrass sub-cover type (5 to 15% shrub cover) is included with the grassland cover type in this document. Likewise, the shrubland cover type map delineation includes the dense shrubland (>25% shrub cover) sub-cover type. These sub-cover types are not specifically delineated on cover type maps; however, in order to adequately describe the range of habitat variability on the

SUR, transect results and summary tables for shrubgrass and dense shrubland cover types are described separately.

Grassland

The predominant perennial grass species in the grassland cover type include bluebunch wheatgrass, Sandberg bluegrass, and Idaho fescue. Introduced grasses, crested wheatgrass and Siberian wheatgrass, are also present. Forbs are represented primarily by lomatium, lupine, and yarrow while shrubs consist of big sagebrush, gray rabbitbrush, stiff sagebrush, and three-tip sagebrush. Cheatgrass, annual forbs, and other introduced species comprise almost 45 percent of the relative cover (Tables 23 and 24).

Shrubgrass

Bluebunch wheatgrass and Sandberg bluegrass along with trace amounts (<1 percent relative cover) of Idaho fescue and bottlebrush squirreltail were documented on the HEP transects within this cover type. Forbs such as lomatium and yarrow comprise just under 20 percent cover. In contrast, relative cover of cheatgrass and exotic annual forbs is 58 percent. The shrub stratum includes gray rabbitbrush, big sagebrush, stiff sagebrush, and purple sage. Transect results are summarized on Tables 25 and 26.

Dense Shrubland[24]

Big sagebrush dominates the landscape in the dense shrubland cover type on the SUR. Three-tip sagebrush, gray rabbitbrush, green rabbitbrush, Douglas hawthorn, rose, mock orange, and willow are also present. The grass component consists primarily of bluebunch wheatgrass, Thurber's needlegrass, and bluegrass species while lupin, lomatium, and yarrow comprise the forb stratum. Cheatgrass and introduced annual forbs are widespread and make up almost 38 percent of the relative cover (Tables 27 and 28).

Riparian shrub[25]

The riparian shrub cover type is a diverse mix of shrubs including mock-orange, serviceberry, chokecherry, Douglas hawthorn, rose, currant, and willow species. This cover type is primarily associated with intermittent streams.

Conifer Forest[25]

The small amount of conifer forest in this Unit is comprised of ponderosa pine and Douglas fir while the shrub understory consists primarily of bitterbrush, snowberry, serviceberry and ocean spray. The grassland component is composed of a combination of pinegrass, elk sedge, bluebunch wheatgrass, and/or Idaho fescue.

[24] Dense shrubland is greater than 25 percent shrub cover and is cover type mapped as shrubland.

[25] Cover type descriptions are based on observations by WDFW biologists not empirical data.

Riverine[25]

This cover type is located within the high water mark of the Yakima River and is comprised largely of a rock/gravel stratum influenced by annual hydrological processes. Woody debris deposited during flood events dots the shoreline. In areas where deep soils border the river, herbaceous cover extends to the water's edge.

Re-vegetated fields/grassland[25]

This cover type consists of two areas totaling 850 acres of weed infested grassland that was seeded to native like grasses, forbs, and big sagebrush (funding provided by BPA and the RMEF). These sites, comprised of the lower Cottonwood Creek drainage (650 acres) and the McCabe Ranch homestead (200 acres) were seeded in 1998 and 1999 respectively.

Table 23. Mean percent frequency, cover, and relative cover of herbaceous vegetation for the grassland cover type (transects 40, 45, 46, 47, 48, 50, 52).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Sandberg bluegrass	74.29	6.82	7.38
	Bottlebrush squirreltail	1.43	0.03	0.03
	Bluebunch wheatgrass	60.35	16.19	16.53
	Idaho fescue	16.79	2.23	2.24
	Crested wheatgrass	1.43	0.10	0.11
	Wheatgrass	8.57	2.25	2.44
	Siberian wheatgrass	11.79	4.75	5.14
	Bluegrass	10.36	1.99	2.15
	Ampla bluegrass	0.71	0.03	0.03
	Bulbous bluegrass	1.43	0.12	0.13
subtotal			**(34.51)**	**(37.36)**
Forbs	Lomatium	48.93	4.18	4.53
	Lupine	11.79	1.53	1.66
	Buckwheat	24.64	2.98	3.22
	Yarrow	13.93	0.63	0.68
	Other forbs	72.86	7.40	8.01
subtotal			**(16.72)**	**(18.10)**
Exotic spp.	Cheatgrass	52.14	31.35	33.94
	Annual forbs	94.64	9.78	10.59
subtotal			**(41.13)**	**(44.53)**
TOTAL			**(92.36)**	**(100.00)**

Table 24. Comparison of mean percent canopy cover and constancy for the grassland cover type (transects 40, 45, 46, 47, 48, 50, 52).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Stiff sagebrush	0.59	42.86
	Big sagebrush	1.10	71.43
	Threetip sagebrush	0.07	28.57
	Gray rabbitbrush	0.77	71.43
subtotal		**(2.53)**	
Grasses	Sandberg bluegrass	6.82	85.71
	Bottlebrush squirreltail	0.03	28.57
	Bluebunch wheatgrass	16.19	85.71
	Idaho fescue	2.23	42.86
	Crested wheatgrass	0.10	14.29
	Wheatgrass	2.25	14.29
	Siberian wheatgrass	4.75	14.29
	Bluegrass	1.99	14.29
	Ampla bluegrass	0.03	14.29
	Bulbous bluegrass	0.12	14.29
subtotal		**(34.51)**	
Forbs	Lomatium	4.18	71.43
	Lupine	1.53	42.86
	Buckwheat	2.98	57.14
	Yarrow	0.63	71.43
	Other forbs	7.40	100.00
subtotal		**(16.72)**	
Exotic spp.	Cheatgrass	31.35	85.71
	Annual forbs	9.78	100.00
subtotal		**(41.13)**	
TOTAL COVER		**(94.89)**	

Table 25. Mean percent frequency, cover, and relative cover of herbaceous vegetation for the shrubgrass cover type (transects 49 and 51).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Sandberg bluegrass	67.50	3.45	6.01
	Bottlebrush squirreltail	1.25	0.03	0.04
	Bluebunch wheatgrass	47.50	8.92	15.53
	Idaho fescue	2.50	0.25	0.44
subtotal			**(12.64)**	**(22.02)**
Forbs	Lomatium	55.00	3.00	5.23
	Buckwheat	13.75	1.11	1.92
	Yarrow	10.00	0.51	0.88
	Other forbs	71.25	6.80	11.85
subtotal			**(11.41)**	**(19.88)**
Exotic spp.	Cheatgrass	90.00	13.91	24.22
	Annual forbs	96.25	19.45	33.88
subtotal			**(33.36)**	**(58.10)**
TOTAL			**(57.41)**	**(100.00)**

Table 26. Comparison of mean percent canopy cover and constancy for the shrubgrass cover type (transects 49 and 51).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Stiff sagebrush	2.07	50.00
	Big sagebrush	2.70	100.00
	Purple sage	0.13	50.00
	Gray rabbitbrush	3.44	100.00
subtotal		**(8.33)**	
Grasses	Sandberg bluegrass	3.45	100.00
	Bottlebrush squirreltail	0.03	50.00
	Bluebunch wheatgrass	8.92	100.00
	Idaho fescue	0.25	50.00
subtotal		**(12.64)**	
Forbs	Lomatium	3.00	100.00
	Buckwheat	1.11	100.00
	Yarrow	0.51	100.00
	Other forbs	6.80	100.00
subtotal		**(11.41)**	
Exotic spp.	Cheatgrass	13.91	100.00
	Annual forbs	19.45	100.00
subtotal		**(33.36)**	
TOTAL COVER		**(65.74)**	

Table 27. Mean percent frequency, cover, and relative cover of herbaceous vegetation within the dense shrub cover type (transects 07, 41, 42, 43, 44).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Sandberg bluegrass	59.50	10.50	14.78
	Thurber's needlegrass	2.00	0.22	0.32
	Bluebunch wheatgrass	38.00	8.30	11.69
	Bulbous bluegrass	18.00	10.19	14.35
	Other grasses	19.50	3.05	4.29
subtotal			**(32.26)**	**(45.43)**
Forbs	Lomatium	15.50	1.14	1.61
	Lupine	31.50	4.99	7.03
	Yarrow	5.50	0.28	0.39
	Other forbs	54.00	5.50	7.74
subtotal			**(11.91)**	**(16.77)**
Exotic spp.	Cheatgrass	70.50	11.11	15.64
	Annual forbs	74.50	15.74	22.16
subtotal			**(26.85)**	**(37.80)**
TOTAL			**(71.02)**	**(100.00)**

Table 28. Comparison of mean percent canopy cover and constancy for the dense shrub cover type (transects 07, 41, 42, 43, 44).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Blue elderberry	0.09	20.00
	Big sagebrush	30.10	80.00
	Green rabbitbrush	1.82	80.00
	Gray rabbitbrush	0.55	80.00
	Threetip sagebrush	4.01	80.00
	Douglas hawthorn	0.26	20.00
	Mock-orange	0.24	20.00
	Choke cherry	0.11	20.00
	Currant	0.04	20.00
	Rose	0.98	20.00
	Willow	8.75	20.00
subtotal		**(46.95)**	
Grasses	Sandberg bluegrass	10.50	80.00
	Thurber's needlegrass	0.22	20.00
	Bluebunch wheatgrass	8.30	80.00
	Bulbous bluegrass	10.19	60.00
	Other grasses	3.05	60.00
subtotal		**(32.26)**	
Forbs	Lomatium	1.14	80.00
	Lupine	4.99	80.00
	Yarrow	0.28	80.00
	Other forbs	5.50	80.00
subtotal		**(11.91)**	
Exotic spp.	Cheatgrass	11.11	80.00
	Annual forbs	15.75	80.00
subtotal		**(26.85)**	
TOTAL COVER		**(117.97)**	

Future Landscape Conditions: Aggressive weed control and restoration of grasslands and other upland sites to native-like plant communities are proposed. This unit has moderate to heavy weed infestations including knapweed, thistles, and cheatgrass. Weedy sites are primarily located adjacent to roads and on disturbed sites associated with past intensive livestock grazing and feed lot operations. Increasing the amount of riparian habitat is also planned.

CHAPTER III. D. Roza Creek Unit Present/Future Landscape Conditions

Present Landscape Conditions: The 12,852 acre Roza Creek Unit is comprised of six cover types i.e., grassland, shrubland, riparian shrub, riparian forest, re-vegetated fields/grasslands, and riverine (Figure 4). Cover types and acreage are listed in Table 29.

Table 29. Roza Creek Unit cover types and acreage.

COVER TYPE	ACRES
Grassland	10,323
Shrubland	2,156
Riparian Shrub	128
Riparian Forest	94
Re-vegetated fields/grasslands	63
Riverine	88
TOTAL	12,852

The following paragraphs describe present habitat conditions by cover type on the Roza Creek Unit. The information is derived from data collected during the HEP analysis except where noted. Plant community data is limited for this Unit because only HEP model variable data was collected during the early stages of the HEP analysis (HEP model habitat variables do not require plant species specific information in most cases).

Grassland

The predominant perennial grasses are bluebunch wheatgrass, Sandberg bluegrass and Idaho fescue followed by bottlebrush squirreltail, Henderson ricegrass, and Thurber's needlegrass. Forbs are well represented and include arrowleaf balsamroot, violets, fleabane, lomatium, narrowleaf goldenrod, and other undifferentiated forb species. Stiff sagebrush is present on shallow rocky soils. Cheatgrass and introduced annual forbs are well dispersed throughout the cover type and comprise approximately 13 percent of the relative cover (Tables 30 and 31).

Shrubland/Dense Shrubland

Shrub species documented during the HEP analysis include three-tip sagebrush, big sagebrush, green rabbitbrush, bitterbrush, and gray rabbitbrush (Tables 32 and 33). WDFW Biologists suggest that herbaceous plant composition is similar to that found in the grassland cover type.

Riparian Shrub[26]

Riparian shrub areas in this Unit consist of one or more of the following shrub species: mock-orange, serviceberry, chokecherry, Douglas hawthorn, currant, rose and willow. Empirical data or anecdotal information regarding the herbaceous stratum is not available at this junctor.

Riparian Forest[26]

A narrow band of riparian forest, consisting primarily of black cottonwood and quaking aspen trees, parallels four miles of Roza Creek in this Unit. The shrub under-story is comprised of willows, Douglas maple, serviceberry and red-osier dogwood. Herbaceous cover includes basin wildrye, bluebunch wheatgrass, bluegrass species, and introduced weeds such as cheatgrass and knapweed.

Riverine[26]

This cover type is located within the high water mark of the Yakima River and is comprised largely of a rock/gravel stratum influenced by annual hydrological processes. Woody debris deposited during flood events dots the shoreline. In areas where deep soils border the river, herbaceous cover extends to the water's edge.

Re-vegetated Fields/Grassland[26]

Sixty acres of knapweed infested grassland at the mouth of Roza Creek were chemically treated in 1998 and planted to native-like herbaceous cover and big sagebrush in 1999. Initial post seeding field inspections indicate seeded vegetation is becoming established on this site. Follow-up weed control activities will be required annually.

[26] Information provided by WDFW Biologists.

Table 30 Mean percent frequency, cover, and relative cover of herbaceous vegetation for the grassland cover type (transects 05, 55, 56, 57).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Sandberg bluegrass	55.21	3.43	7.57
	Bottlebrush squirreltail	0.63	0.71	1.56
	Bluebunch wheatgrass	50.83	17.58	38.85
	Idaho fescue	18.75	2.94	6.49
	Henderson ricegrass	1.88	0.03	0.06
	Thurber's needlegrass	0.63	0.01	0.03
subtotal			**(24.68)**	**(54.55)**
Forbs	Lomatium	12.50	0.51	1.13
	Fleabane	11.46	0.55	1.22
	Buckwheat	44.17	6.65	14.70
	Arrowleaf balsamroot	23.97	3.06	6.77
	Desert yellow fleabane	2.50	0.07	0.15
	Narrowleaf goldenweed	3.13	0.19	0.41
	Violet	20.00	0.56	1.23
	Other forbs	49.17	2.98	6.58
subtotal			**(14.57)**	**(32.20)**
Exotic spp.	Cheatgrass	51.25	2.73	6.03
	Annual forbs	69.58	3.26	7.21
subtotal			**(5.99)**	**(13.25)**
TOTAL			**(45.24)**	**(100.00)**

Table 31. Comparison of mean percent canopy cover and constancy for the grassland cover type (transects 05, 55, 56, 57).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Stiff sagebrush	5.85	50.00
	Unknown shrub	0.73	25.00
subtotal		**(6.58)**	
Grasses	Sandberg bluegrass	3.43	75.00
	Bottlebrush squirreltail	0.71	25.00
	Bluebunch wheatgrass	17.58	75.00
	Idaho fescue	2.94	50.00
	Henderson ricegrass	0.03	25.00
	Thurber's needlegrass	0.01	25.00
subtotal		**(24.68)**	
Forbs	Lomatium	0.51	50.00
	Fleabane	0.55	50.00
	Buckwheat	6.65	75.00
	Arrowleaf balsamroot	3.06	50.00
	Desert yellow fleabane	0.07	25.00
	Narrowleaf goldenweed	0.19	25.00
	Violet	0.56	25.00
	Other forbs	2.98	75.00
subtotal		**(14.57)**	
Exotic spp.	Cheatgrass	2.73	75.00
	Annual forbs	3.26	75.00
subtotal		**(5.99)**	
TOTAL COVER		**(51.82)**	

Table 32. Comparison of mean percent canopy cover and constancy for the shrubland cover type (transect 02).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Gray rabbitbrush	0.19	100.00
	Green rabbitbrush	0.33	100.00
	Threetip sagebrush	23.13	100.00
	Big sagebrush	0.33	100.00
subtotal		**(23.98)**	
Grasses	No Data		
subtotal		**(0.00)**	
Forbs	No Data		
subtotal		**(0.00)**	
Exotic spp.	No Data		
subtotal		**(0.00)**	
TOTAL COVER		**(23.98)**	

Table 33. Comparison of mean percent canopy cover and constancy for the dense shrub cover type (transect 04).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Big sagebrush	8.63	100.00
	Bitterbrush	0.50	100.00
	Green rabbitbrush	0.20	100.00
	Gray rabbitbrush	3.06	100.00
	Threetip sagebrush	15.59	100.00
subtotal		**(27.98)**	
Grasses	No Data		
subtotal		**(0.00)**	
Forbs	No Data		
subtotal		**(0.00)**	
Exotic spp.	No Data		
subtotal		**(0.00)**	
TOTAL COVER		**(27.98)**	

Future Landscape Conditions: Enhancement activities are designed to restore weed invested grasslands to more natural like conditions by aggressively controlling weeds and seeding competitive herbaceous cover as needed. Like other Management Units on the WWA, exotic weeds such as knapweed, thistle, and cheatgrass are well dispersed and are extremely dense on some micro sites; especially within the Roza Creek drainage, along roads, and in areas disturbed by former livestock operations. The riparian forest cover type will be expanded and enhanced by increasing productivity and stem density of cottonwood and aspen trees through silviculture treatments and natural successional processes. Weed control will continue on re-vegetated grasslands as well develop additional sites along Roza Creek.

CHAPTER III. E. Umtanum Creek Unit Present/Future Landscape Conditions

Present Landscape Conditions: The 26,099 acre Umtanum Creek Unit is comprised of seven cover types i.e., grassland, shrubland, riparian shrub, riparian forest, conifer forest woodland, conifer forest-medium, and riverine (Figure 4). Cover types and acreage are listed in Table 34.

Table 34. Umtanum Creek Unit cover types and acreage.

COVER TYPE	ACRES
Grassland	17,325
Shrubland	7,551
Riparian Shrub	80
Riparian Forest	244
Conifer Forest-Woodland	671
Conifer Forest-Medium	34
Riverine	194
TOTAL	26,099

The following paragraphs describe present habitat conditions by cover type on the Umtanum Creek Unit. The information is derived from data collected during the HEP analysis except where noted.

Grassland

Transect results show that bluebunch wheatgrass and Sandberg bluegrass dominate the grass stratum followed by Idaho fescue and bottlebrush squirreltail. The relative cover of forbs, such as lomatium, arrowleaf balsamroot, fleabane, and buckwheat is almost identical to grasses (43 percent and 44 percent respectively). Stiff sagebrush and three-tip sagebrush are the dominant shrub species in this

cover type. Trace amounts[27] of bitterbrush, snowberry, green rabbitbrush, and big sagebrush are also present. Cheatgrass and introduced annual forbs comprise approximately 12 percent of the relative cover (Tables 35 and 36).

Shrubgrass

Predominant grasses in this cover type include bluebunch wheatgrass, Basin wildrye, and Idaho fescue. Thickspike wheatgrass, Sandberg bluegrass, sedge, and rush are also present. The forb stratum is comprised primarily of buckwheat, lomatium, and yarrow while exotic vegetation such as cheatgrass, annual forbs, and other introduced species make up nearly 30 percent of all herbaceous relative cover. Dominant shrubs include three-tip sagebrush, stiff sagebrush, and big sagebrush (Tables 37 and 38).

Shrubland

The shrubland cover type is comprised of a diverse assemblage of shrubs dominated by three-tip sagebrush and big sagebrush. Bitterbrush, gray and green rabitbrush, wax currant, stiff sagebrush, and Wood's rose are also found throughout the cover type. Bluebunch wheatgrass dominates the grass stratum followed by Idaho fescue and Sandberg bluegrass. Forbs are similar to those described for the shrubgrass cover type. Cheatgrass and other introduced species are well dispersed and comprise 24 percent relative cover (Tables 39 and 40).

Dense Shrubland

Bitterbrush dominates the landscape in this cover type. Big sagebrush, snowberry, green and gray rabbitbrush, three-tip sagebrush, and wax currant are also present. Although the grass stratum is comprised largely of bluebunch wheatgrass and Sandberg bluegrass, Sherman big bluegrass, Idaho fescue, Basin wildrye, bottlebrush squirreltail, and Cusick's bluegrass are also found in trace amounts throughout the cover type. Forbs, comprising approximately 18 percent relative cover, were recorded in at least 50 percent of the micro plots (includes buckwheat, lomatium, lupine, and numerous undifferentiated forbs). In contrast, cheatgrass and other introduced plant species contribute more than 58 percent towards the total relative cover (Tables 41 and 42).

Riparian Forest[28]

The riparian forest cover type extends approximately ten miles along Umtanum Creek and is comprised of a diverse mix of conifer and deciduous tree and shrub species. Douglas fir and ponderosa pine are the predominant conifer trees while black cottonwood, quaking aspen and Douglas maple are the primary deciduous trees. The shrub component generally consists of mock-orange, ocean spray, red-osier dogwood, wax currant, serviceberry, snowberry, rose, and willow.

[27] Less than one percent cover.

[28] Cover type description provided by WDFW Biologists.

Conifer Forest[28,29]

Small amounts of this fragmented cover type are located in the upper portion of the Umtanum Creek watershed. The two predominant conifer species are ponderosa pine and Douglas fir.
The shrub under-story is comprised of snowberry, wax currant, bitterbrush and, at higher elevations, snowbrush ceanothus is present. Herbaceous cover generally consists of one or more of the following species: pinegrass, elk sedge, Idaho fescue and bluebunch wheatgrass.

Riverine[28]

This cover type is located within the high water mark of the Yakima River and is comprised largely of a rock/gravel stratum influenced by annual hydrological processes. Woody debris from flood events is deposited along the littoral zone. In areas where deep soils border the river, herbaceous cover extends to the water's edge.

[29] Includes both conifer woodland and conifer woodland - medium cover types.

Table 35. Mean percent frequency, cover, and relative cover of grass and forb species for the grassland cover type (transects 27, 33, 34, 53, 54, 108).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Sandberg bluegrass	87.29	10.31	14.95
	Bottlebrush squirreltail	12.08	0.22	0.32
	Bluebunch wheatgrass	46.25	14.06	20.39
	Idaho fescue	36.14	5.37	7.79
subtotal			**(29.96)**	**(43.45)**
Forbs	Lomatium	33.33	5.68	8.24
	Sagebrush violet	13.75	0.58	0.84
	Arrowleaf balsamroot	8.33	0.71	1.03
	Fleabane	16.46	1.09	1.58
	Phlox	7.50	0.31	0.45
	Buckwheat	59.06	11.41	16.55
	Yarrow	2.50	0.13	0.19
	Other forbs	87.50	10.52	15.26
subtotal			**(30.43)**	**(44.13)**
Exotic spp.	Cheatgrass	8.75	0.39	0.57
	Annual forbs	94.90	8.18	11.86
subtotal			**(8.57)**	**(12.43)**
TOTAL			**(68.96)**	**(100.00)**

Table 36. Comparison of mean percent canopy cover and constancy for the grassland cover type (transects 27, 33, 34, 53, 54, 108).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Stiff sagebrush	5.23	60.00
	Big sagebrush	0.04	20.00
	Threetip sagebrush	1.54	60.00
	Bitterbrush	0.36	20.00
	Green rabbitbrush	0.05	20.00
	Snowberry	0.06	20.00
subtotal		**(7.28)**	
Grasses	Sandberg bluegrass	10.31	100.00
	Bottlebrush squirreltail	0.22	83.00
	Bluebunch wheatgrass	14.06	50.00
	Idaho fescue	5.37	50.00
subtotal		**(29.96)**	
Forbs	Lomatium	5.68	50.00
	Sagebrush violet	0.58	17.00
	Arrowleaf balsamroot	0.71	17.00
	Fleabane	1.09	50.00
	Phlox	0.31	17.00
	Buckwheat	11.41	83.00
	Yarrow	0.13	17.00
	Other forbs	10.52	100.00
subtotal		**(30.43)**	
Exotic spp.	Cheatgrass	0.39	50.00
	Annual forbs	8.18	100.00

Table 37. Mean percent frequency, cover, and relative cover of grass and forb species for the shrubgrass cover type (transects 28, 31, 37).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Sandberg bluegrass	45.83	3.00	3.50
	Bluebunch wheatgrass	55.83	11.80	13.75
	Thickspike wheatgrass	17.50	4.17	4.86
	Rye	27.50	10.91	12.71
	Rush	13.33	2.25	2.62
	Sedge	22.50	7.87	9.17
	Idaho Fescue	25.83	5.44	6.34
subtotal			**(45.44)**	**(52.95)**
Forbs	Lomatium	33.33	3.55	4.14
	Iris	8.33	0.18	0.21
	Yarrow	42.50	1.80	2.10
	Fleabane	3.33	0.25	0.29
	Buckwheat	30.83	5.02	5.85
	Carey's balsamroot	5.83	0.45	0.52
	Other forbs	45.00	3.50	4.08
subtotal			**(14.76)**	**(17.20)**
Exotic spp.	Cheatgrass	25.83	0.48	0.55
	Annual forbs	80.83	21.38	24.92
	Other exotics	10.83	3.76	4.38
subtotal			**(25.62)**	**(29.85)**
TOTAL			**(85.81)**	**(100.00)**

Table 38. Comparison of mean percent canopy cover and constancy for the shrubgrass cover type (transects 28, 31, 37).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Stiff sagebrush	2.22	33.33
	Green rabbitbrush	1.62	33.33
	Threetip sagebrush	3.86	66.66
	Bitterbrush	1.31	33.33
	Gray rabbitbrush	0.66	33.33
	Big sagebrush	2.19	33.33
subtotal		**(11.86)**	
Grasses	Sandberg bluegrass	3.00	66.66
	Bluebunch wheatgrass	11.80	66.66
	Thickspike wheatgrass	4.17	33.33
	Rye	10.91	33.33
	Rush	2.25	33.33
	Sedge	7.87	33.33
	Idaho fescue	5.44	33.33
subtotal		**(45.44)**	
Forbs	Lomatium	3.55	66.66
	Iris	0.18	33.33
	Yarrow	1.80	66.66
	Fleabane	0.25	33.33
	Buckwheat	5.02	66.66
	Carey's balsamroot	0.45	33.33
	Other forbs	3.50	100.00
subtotal		**(14.76)**	
Exotic spp.	Cheatgrass	0.48	33.33
	Annual forbs	21.38	100.00
	Other exotics	3.76	66.66
subtotal		**(25.62)**	
TOTAL COVER		**(97.67)**	

Table 39. Mean percent frequency, cover, and relative cover of grass and forb species for the shrubland cover type (transects 109, 35, 36, 58).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Sandberg bluegrass	55.00	6.20	5.78
	Bluebunch wheatgrass	87.50	30.23	28.15
	Brome	1.25	0.05	0.04
	Idaho fescue	45.63	8.54	7.95
	Prairie junegrass	5.00	0.83	0.77
	Cusick's bluegrass	5.63	2.71	2.52
subtotal			**(48.55)**	**(45.22)**
Forbs	Lomatium	12.50	0.70	0.65
	Arrowleaf balsamroot	9.38	1.94	1.80
	Yarrow	23.13	1.44	1.34
	Fleabane	21.25	1.85	1.72
	Buckwheat	56.25	17.10	15.93
	Old man's whiskers / Avens	3.13	0.80	0.75
	Other forbs	19.53	9.23	8.59
subtotal			**(33.06)**	**(30.79)**
Exotic spp.	Cheatgrass	15.00	0.93	0.86
	Annual forbs	88.13	14.98	13.95
	Other exotics	23.75	9.86	9.19
subtotal			**(25.77)**	**(24.00)**
TOTAL			**(107.37)**	**(100.00)**

Table 40. Comparison of mean percent canopy cover and constancy for the shrubland cover type (transects 109, 35, 36, 58).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Stiff sagebrush	0.31	25.00
	Green rabbitbrush	0.56	25.00
	Threetip sagebrush	9.13	100.00
	Bitterbrush	1.45	50.00
	Gray rabbitbrush	2.45	75.00
	Big sagebrush	6.74	75.00
	Squaw currant	0.11	25.00
	Wood's rose	0.03	25.00
subtotal		**(20.77)**	
Grasses	Sandberg bluegrass	6.20	100.00
	Bluebunch wheatgrass	30.23	100.00
	Brome	0.05	25.00
	Idaho Fescue	8.54	100.00
	Prairie junegrass	0.83	25.00
	Cusick's bluegrass	2.71	50.00
subtotal		**(48.55)**	
Forbs	Lomatium	0.70	50.00
	Arrowleaf balsamroot	1.94	25.00
	Yarrow	1.44	25.00
	Fleabane	1.85	50.00
	Buckwheat	17.10	100.00
	Old man's whiskers / Avens	0.80	25.00
	Other forbs	9.23	100.00
subtotal		**(33.06)**	
Exotic spp.	Cheatgrass	0.93	100.00
	Annual forbs	14.98	100.00
	Other exotics	9.86	25.00
subtotal		**(25.77)**	
TOTAL COVER		**(128.14)**	

Table 41. Mean percent frequency, cover, and relative cover of grass and forb species for the dense shrub cover type (transects 107, 281, 29, 30, 38, 39).

Stratum	Species	Frequency	Cover	Relative Cover
		-------Percent-------		
Grasses	Sandberg bluegrass	30.27	4.64	7.72
	Bluebunch wheatgrass	32.01	5.73	9.53
	Ampla bluegrass	6.53	2.13	3.54
	Idaho fescue	4.03	0.85	1.41
	Prairie junegrass	0.42	0.02	0.04
	Cusick's bluegrass	0.28	0.01	0.02
	Rye	2.08	0.68	1.13
	Bottlebrush squirreltail	1.67	0.08	0.13
subtotal			**(14.14)**	**(23.51)**
Forbs	Lomatium	12.50	0.83	1.38
	Lupine	0.83	0.05	0.08
	Yarrow	9.86	0.23	0.38
	Fleabane	2.50	0.23	0.37
	Buckwheat	26.74	5.37	8.93
	Phlox	0.28	0.003	0.01
	Arrowleaf balsamroot	0.28	0.10	0.16
	Other forbs	50.00	4.06	6.75
subtotal			**(10.86)**	**(18.06)**
Exotic spp.	Cheatgrass	16.39	9.78	16.26
	Annual forbs	59.38	10.36	17.23
	Other exotics	60.63	14.99	24.93
subtotal			**(35.14)**	**(58.43)**
TOTAL			**(60.13)**	**(100.00)**

Table 42. Comparison of mean percent canopy cover and constancy for the dense shrub cover type (transects 107, 281, 29, 30, 38, 39).

Stratum	Species	(%) Canopy Cover	(%) Constancy
Shrubs	Big sagebrush	8.58	66.67
	Threetip sagebrush	2.27	83.33
	Gray rabbitbrush	3.49	50.00
	Green rabbitbrush	1.22	50.00
	Bitterbrush	27.66	83.33
	Squaw currant	2.45	50.00
	Snowberry	5.18	16.67
subtotal		**(50.85)**	
Grasses	Sandberg bluegrass	4.64	66.66
	Bluebunch wheatgrass	5.73	83.33
	Ampla bluegrass	2.13	33.33
	Idaho fescue	0.85	33.33
	Prairie junegrass	0.02	16.67
	Cusick's bluegrass	0.01	16.67
	Rye	0.68	16.67
	Bottlebrush squirreltail	0.08	16.67
subtotal		**(14.14)**	
Forbs	Lomatium	0.83	50.00
	Lupine	0.05	16.67
	Yarrow	0.23	66.66
	Fleabane	0.23	16.67
	Buckwheat	5.37	83.33
	Phlox	0.003	16.67
	Arrowleaf balsamroot	0.10	16.67
	Other forbs	4.06	66.66
subtotal		**(10.86)**	
Exotic spp.	Cheatgrass	9.78	16.67
	Annual forbs	10.36	66.66
	Other exotics	14.99	66.66
subtotal		**(35.14)**	
TOTAL COVER		**(110.99)**	

Future Landscape Conditions: As with other Management Units, exotic vegetation including knapweed, thistle, and cheatgrass are well dispersed and are extremely dense on some sites such as road right-of-ways. Aggressive weed control and seeding competitive herbaceous cover as needed is proposed to restore shrub-steppe and riparian habitats to more native-like conditions. The riparian forest cover type will be expanded and enhanced by increasing productivity and stem density of cottonwood and aspen trees through silviculture treatments and natural successional processes. Riparian forest/shrub cover type enhancements and improvements to upland habitat will promote water quality within Umtanum Creek and the Yakima River sub-basin.

CHAPTER IV. MANAGEMENT GOALS, OBJECTIVES, AND TASKS

CHAPTER IV. A. Management Goals

The primary goals for the Wenas Wildlife Area are described below. The goals support Agency and Regional programmatic plans and directives and reflect habitat/wildlife needs.

Goal One: Protect, enhance, and manage shrub-steppe and forest ecosystem habitats on the Wenas Wildlife Area for Rocky Mountain elk (*Cervus elaphus nelsoni*), mule deer (*Odocoileus hemionus hemionus*), bighorn sheep (*Ovis canadensis*), sage grouse (*Centrocercus urophasianus*), and other endemic/migratory wildlife species.

Goal Two: Maintain and/or restore riparian habitat and improve water quality and conditions for fish within the Wenas Creek, Roza Creek, and Umtanum Creek drainages.

CHAPTER IV. B. Management Objectives and Tasks

Management objectives for the WWA support one or both management goals. Objectives are linked directly to tasks as follows.

Objective 1: Restore 1,730 acres of abandoned cropland to native like shrub-steppe habitat by the end of FY 2004.

- Task 1.1: Seed 1,250 acres of abandoned cropland at Cottonwood Creek to native like vegetation By end of FY 2003. Maintain seeded areas as required.
- Task 1.2: Seed 80 acres of abandoned cropland at Roza Creek to native like vegetation by end of FY 2003. Maintain seeded areas as required.
- Task 1.3: Seed 200 acres of abandoned cropland at the McCabe Ranch to native like vegetation in FY 2000. Maintain seeded areas as required.

Task 1.4: Seed native like vegetation on 200 acres of cropland located at the Mt. Vale Ranch in FY 1999. Maintain seeded areas as required.

Objective 2: Reduce the amount of introduced vegetation by 50 percent along 350 miles of roads/trails and on 500 acres of shrub-steppe/riparian habitat by the end of FY 2005.

Task 2.1: Initiate an aggressive herbicide weed control program on a minimum of 20 percent (70 miles) of the WWA's roads each year. Conduct follow-up weed control activities as required.

Task 2.2: Control weeds through chemical and mechanical means on 100 acres of shrub-steppe/riparian habitat annually. Conduct follow-up weed control activities as required.

Task 2.3: Release biological weed control agents (insects) at two sites annually beginning in FY 2001.

Task 2.4: Seed competitive native-like vegetation on sites treated in Tasks 2.1, 2.2, and 2.3 commencing in FY 2001 (a minimum of 100 acres per year). Maintain new seedings.

Objective 3: Improve 50 acres of riparian forest/shrub habitat annually through FY 2005.

Task 3.1: Cut decadent cottonwood and aspen trees and leave downed material on site (not to exceed 40% of mature trees with a diameter $\geq$ 16 inches at breast height). Prune remaining tree stock to encourage seedling regeneration and improve stand robustness.

Task 3.2: Construct temporary fences as required to protect tree seedlings from wildlife depredation.

Task 3.3: Seed native like herbaceous vegetation and plant hydrophytic shrubs and trees within riparian zones as needed.

Objective 4: Reduce sediments entering Umtanum Creek by the end of FY 2001 by improving the stream channel road crossing (Durr road) in section 15, T16N, R18E.

Task 4.1: Install culvert or other stream crossing device.

Task 4.2: Contour and re-vegetate area near stream crossing if required.

Objective 5: Abandon and/or re-vegetate 50 miles of road and improve parking and equestrian areas by the end of FY 2005.[30]

Task 5.1: Inventory all roads.

Task 5.2: Identify roads for potential abandonment/remedial actions.

Task 5.3: Conduct appropriate intra/inter Agency and public meetings to obtain input from interested parties on potential road closures.

Task 5.4: Construct barriers and/or install signs informing the public of road closures.

Task 5.5: Conduct remedial activities as required i.e., seed appropriate native-like vegetation etc., on and adjacent to 50 miles of abandoned roadway and maintain as needed.

Task 5.6: Enlarge, enhance and maintain two vehicle parking/equestrian staging areas.

Task 5.7: Develop road management plan.

Objective 6: Maintain operations and maintenance activities as required on WWA lands not included in Objectives 1 through 5 through FY 2005.

Task 6.1: Maintain fences, cattleguards, roads, fire breaks, culverts, signs, and control weeds, etc., as needed throughout the WWA.

CHAPTER V. ENHANCEMENTS

CHAPTER V. A. Background

Proposed enhancement activities support WWA management goals , objectives, and tasks. A multi-disciplinary team, composed of WDFW Vegetation Management Team members, Habitat Biologists, Wildlife Biologists, Fisheries Biologists, and WWA staff, developed and/or reviewed the enhancement proposal section. In addition, this proposal was reviewed by the Wenas Wildlife Area Citizen's Advisory Group. Enhancement activities will be accomplished by WWA staff and Washington Conservation Corps (WCC) members whenever possible.

[30] All activities must comply with Forest Practice Act Rules and Regulations and WDFW guidelines.

Specific enhancements are referenced alpha-numerically in the following paragraphs, maps, and tables. For example, the designator "1a" refers to Shrub-steppe Restoration (1) and the Roza Creek RMEF Cooperative Project (a). Proposed enhancements are summarized below.

(1) SHRUB STEPPE RESTORATION
- a) Roza Creek RMEF Cooperative Project
- b) Cottonwood Creek RMEF Cooperative Project
- c) McCabe RMEF Cooperative Project
- d) Sheep Company Road Projects

(2) WEED MANAGEMENT
- a) Roads
- b) Uplands, Bottoms, and Trails
- c) Biological Controls
- d) Competitive Native-like Vegetation Seedings

(3) RIPARIAN FOREST AND RIPARIAN ENHANCEMENT
- a) Riparian Forest Enhancements (tree and shrub cutting/hedging)
- b) Riparian Area Development

(4) ROAD MANAGEMENT
- a) Umtanum Ridge Access Road
- b) Umtanum Creek Crossing
- c) Hanson Road Project
- d) Skyline Trail Access Project
- e) Forest Practice Act Road Inventories/Closures[31]

As described in the previous example, most enhancements are identified with a specific alpha-numeric designator. There are, however, "generic" activities such as riparian forest enhancements that are assigned the same map designator regardless of the location.

[31] New Forest Practice Act regulations/guidelines will be followed when abandoning and revegetating roads.

CHAPTER V. B. Specific Enhancements

The general locations of enhancements are depicted in Figure7. Specific enhancement are described in the following paragraphs.

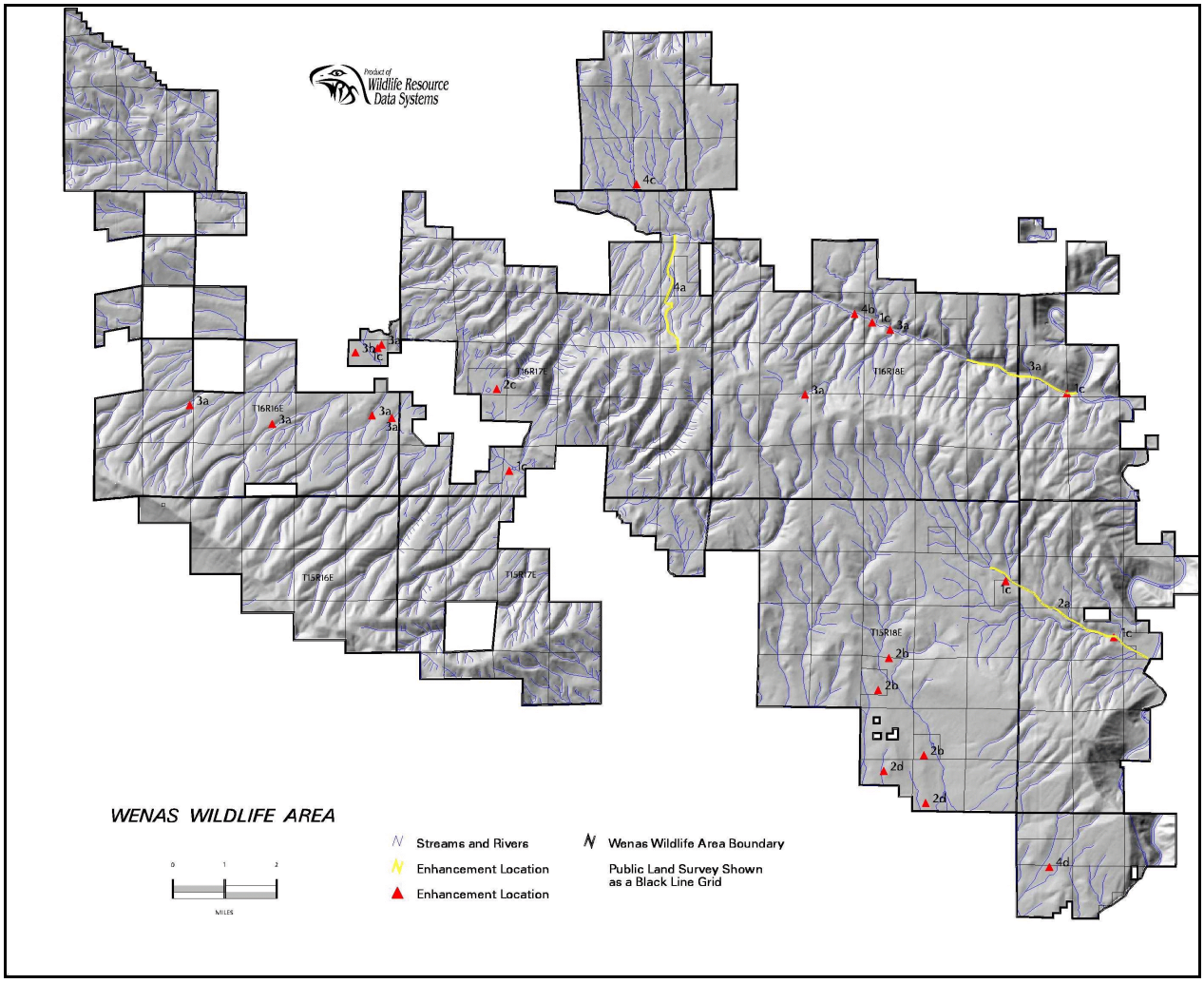


Figure 7. The general locations of enhancements (a larger scale map is included in Attachment 1).

Shrub-steppe Restoration (1)

Roza Creek RMEF Cooperative Project (1a):
This RMEF cooperative project is designed to enhance shrub-steppe and riparian forest habitats in the Roza Creek drainage. Enhancements include controlling weeds, seeding native-like herbaceous vegetation, and planting shrubs and trees. Physical enhancements to improve stream hydrology are planned and include construction of small impoundments, restoration of creek channels, and removal of existing culverts and diversions (all required permits will be obtained before work is initiated). Weeds were controlled on 100 acres in 1998 and on an additional 200 acres in 1999. Moreover, seventy acres at the mouth of Roza Creek were seeded in 1999. Additional weed control measures, stream enhancement activities, and shrub plantings will occur in 2001. Drainage-wide weed control will be conducted on approximately 1,500 acres over the next five years (Figure 8).

Cottonwood Creek RMEF Cooperative Project (1b):
This RMEF cooperative project will restore existing weed infested grasslands to native-like shrub-steppe habitat. Planned enhancements include planting native grasses and shrubs and reducing weed competition as needed. Weed control and seeding occurred on approximately 600 acres in 1998, followed by an additional herbicide application and tillage/seeding of 225 acres in 1999. Follow-up weed control, tillage, and seeding operations will be conducted in 2000. Ultimately, restoration of the lower Cottonwood Creek drainage will encompass 1,650± acres. Streambed restoration and limited shrub planting will continue along Cottonwood Creek after grassland restoration has been completed (Figure 9).

McCabe RMEF Cooperative Project (1c):
This RMEF cooperative project is designed to restore former agricultural land to native-like shrub-steppe habitat and to enhance existing riparian/wetland sites. Approximately 250 acres were seeded to native-like herbaceous vegetation in 1999. Future work includes: controlling weeds, planting shrubs and trees, fencing woody plantings (to protect them from elk/deer depredation), and enhancing existing ponds and wetland areas (Figure10).

Sheep Company Road Projects (1d):
This project is similar to other RMEF cooperative projects and includes replanting 150 acres to shrub-steppe habitat, intensive weed control on an additional 200 acres not suitable for replanting, removal of demolished farmstead buildings and debris, repair and operation of an existing well to provide short-term irrigation of new shrub and tree plantings, and construction of fence enclosures to temporarily protect shrub and tree plantings from elk depredation. Annual weed control will continue on the project until native-like vegetation replaces undesirable introduced plant species (Figure 9).

Weed Management (2)

Weed Management - Roads (2a):
There are approximately 350 miles of road on the Wenas Wildlife Area of which one half are open to public use (green dot). Both open and closed roads exhibit some degree of weed infestation. An aggressive weed control program is planned over the next five years with open roads commanding the highest priority. Budget estimates are based solely on the cost of chemical herbicide at 35 dollars per acre, exclusive of any additional costs for contracting this work commercially. Commercial application would raise the per acre cost to between 130 to 170 dollars per acre. Weed control treatments will occur on most areas annually or until desired levels of control are achieved (Figure 11). WWA staff will develop a plan to control weeds on at least 50 miles of road per year.

Weed Management on Uplands, Bottoms, and Trails (2b):
Throughout the entire Wenas WA there are localized infestations of noxious weeds varying widely in size and density. An aggressive 5 year weed control program is planned (weed control measures will continue as long as needed). While springs and riparian bottoms will receive the highest priority, additional weed control measures will be required to reduce knapweed, thistle and other exotics on upland sites.

Biological Weed Control (2c):
Biological control agents will be purchased annually from Idaho State University and/or Washington State University, and will be dispersed on key sites to supplement and/or provide an alternative to herbicide applications. Once established, biological control agents will be collected from local sites and dispersed to other areas on the WWA. Biological control agents have been released on other wildlife areas in Washington and are consistent with WDFW's integrated vegetation management strategy (Figures 10, 12, and 13).

Competitive Native-like Vegetation Seedings (2d):
Native-like herbaceous vegetation will be established on treated sites to compete with exotic vegetation (this should result in a reduction in the number and intensity of future herbicide applications). Generally, native seed mixtures will be applied at a rate of 10 pounds per acre unless otherwise indicated by site specific conditions.

<u>Riparian Forest and Riparian Enhancements</u> (3)

Riparian Forest Enhancements (3a):
The succession of various riparian tree/shrub stands will be set back by cutting or hedging trees and shrubs to stimulate new growth and increase plant vigor. These sites include locations in the Wenas and Umtanum Creek drainages, along with upland sites at Wright and Oasis Springs. Fencing of treated stands may be required to protect new growth from deer, elk and bighorn sheep depredation (Figures 12, 13, and 14).

Riparian Area Development (3b):

Riparian forest/shrub habitat will be developed on a former alfalfa field at the Mt. Vale Headquarters site (Figure 12). Existing wells will be used to irrigate the proposed enhancement. Weed control and protective fencing are also planned. Exercising water rights for this purpose will ensure that WDFW retains its water rights to the wells (inactivity for 5 years will result in the loss of water rights).

Road Management (4)

Umtanum Ridge Access Road (4a).
This primitive road located adjacent to Umtanum Creek (a Type 3 stream) will be abandoned, seeded to native vegetation, and maintained by WDFW in order to reduce road density and eliminate a source of stream siltation. Work will include restoration of the adjacent stream channel to its historical flow pattern, removal of five existing culverts, planting and fencing of shrubs and trees along the stream, and heavy thinning of several small, decadent aspen stands. Thinned areas (generally 1-2 ac) will be temporarily fenced to prevent damage by browsing elk (Figure 15).

Umtanum Creek Crossing (4b):
An existing rock ford through Umtanum Creek allows considerable sediment and vehicle related pollutants into the creek. Alternatives to the existing ford will be considered to determine the most cost effective/practicable replacement option. Potential improvements include: installation of a concrete box culvert, installation of a metal culvert of sufficient size to meet flow requirements, improvement of the existing ford to allow for dry vehicle crossing during typical low flow regimes, and installation of a full bridge. Off-road vehicle access and overnight camping will be restricted to protect riparian habitat and reduce disturbance to fragile soils. Intensive weed control measures will be conducted to reduce noxious weeds on the site. Additionally, grass seeding and riparian tree enhancements will take place on disturbed riparian areas (Figure 13).

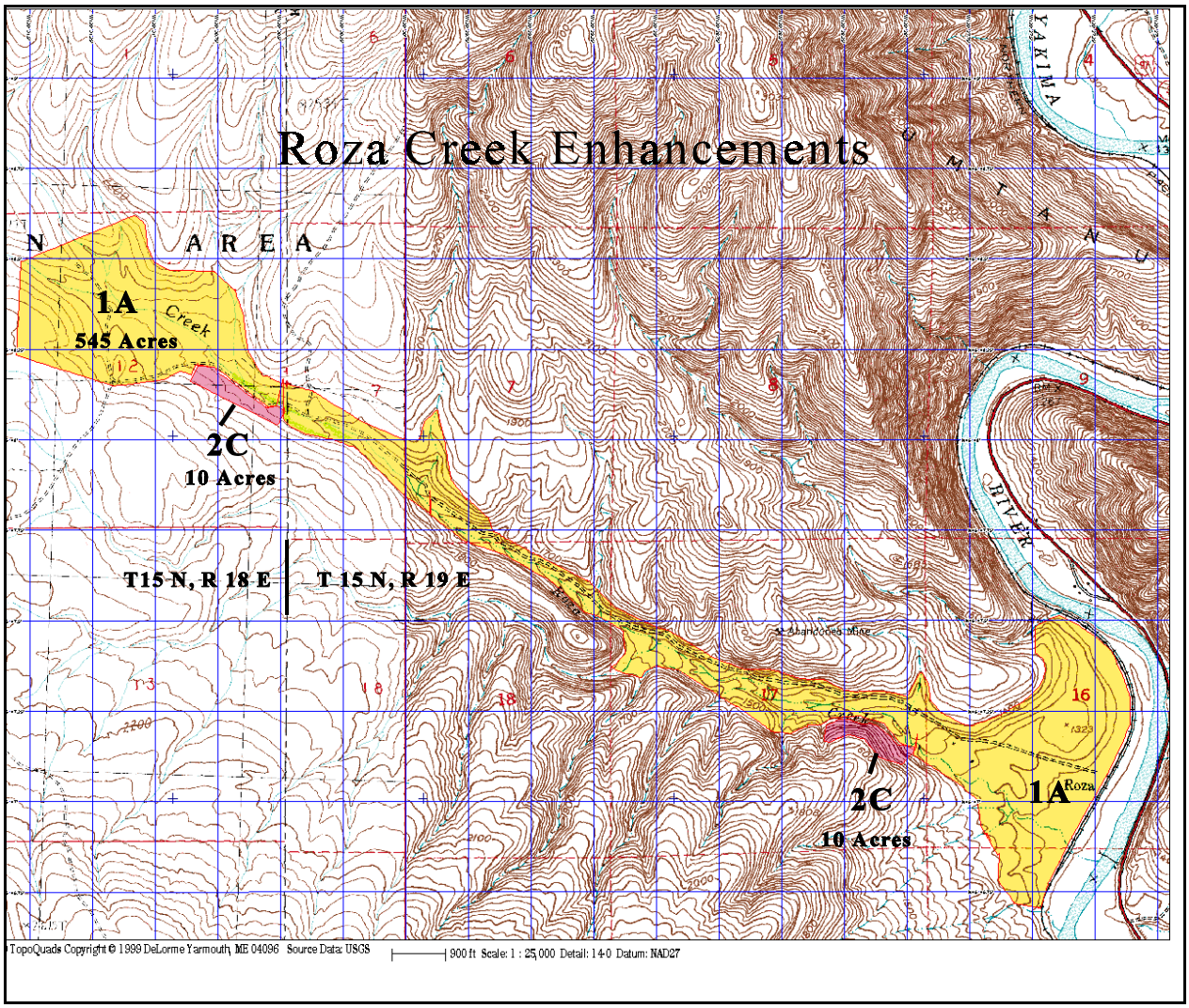
Hanson Road Project (4c):
A spring-fed two acre artificial impoundment (formerly used for stock watering) will be partially breached or allowed to drain to restore surface/subsurface flow to historical riparian habitat. An existing road will be closed and relocated out of the riparian zone followed by restoration of the riparian area. Temporary protective fencing will be constructed as needed to prevent degradation of shrubs and trees by elk and other wildlife species (Figure 16).

Skyline Trail Access Project (4d):
A high use weed infested ATV road will be abandoned and re-vegetated with native-like shrub-steppe vegetation. An existing parking lot and horse staging area at the entrance gate will be enlarged and enhanced to offset the loss of the closed road, which has traditionally been used by equestrian groups as access/parking for horse trailers (Figure 17).

Forest Practice Act Road Abandonments (4e):

A road management plan will be developed and will identify which roads should be abandoned or repaired. All remaining roads throughout the WWA will be restored in order to reduce the spread of noxious weeds and reduce stream sedimentation.

Figure 8. Roza Creek enhancement and biological weed control agent release sites.



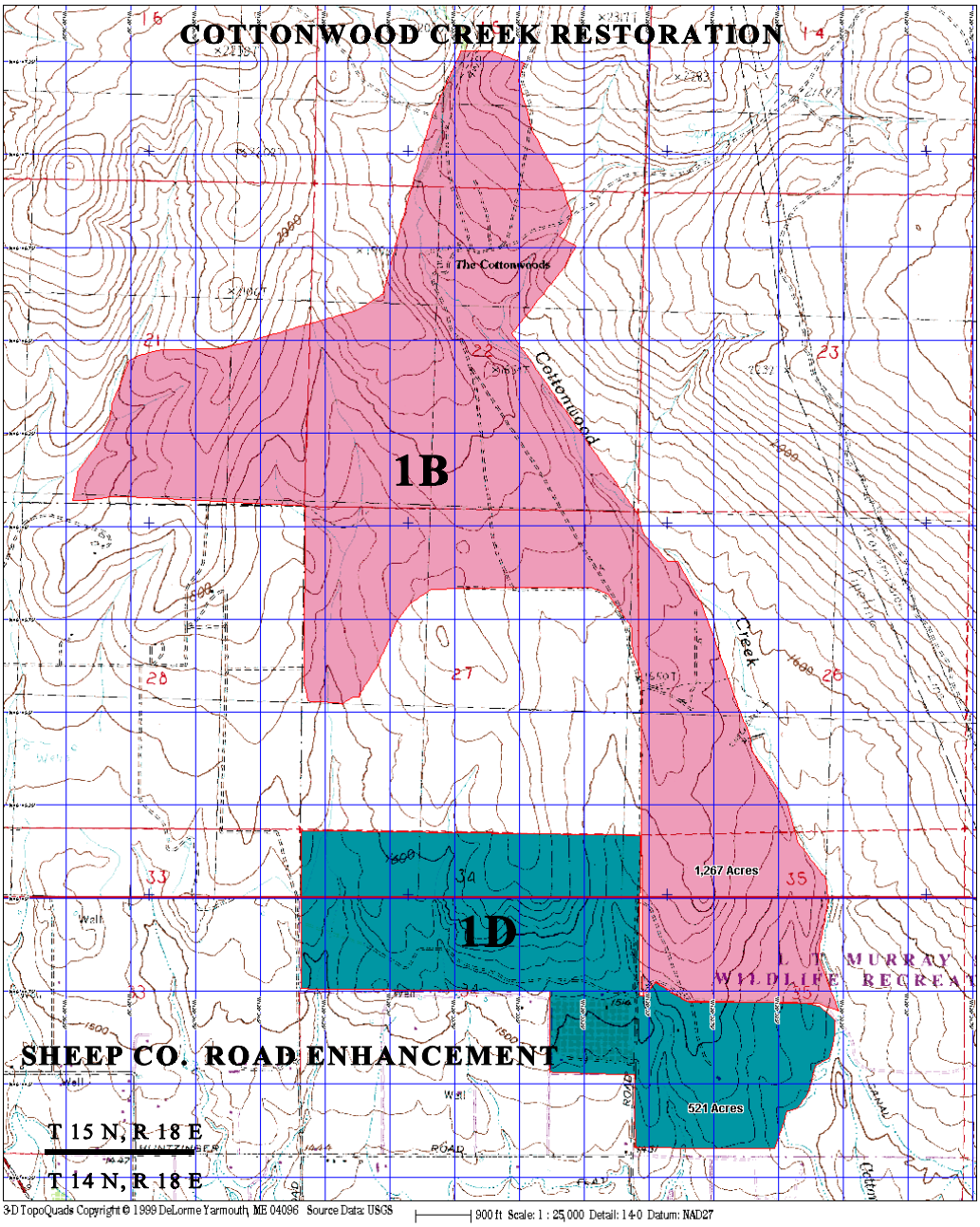


Figure 9. Cottonwood Creek and Sheep Company Road enhancement map.

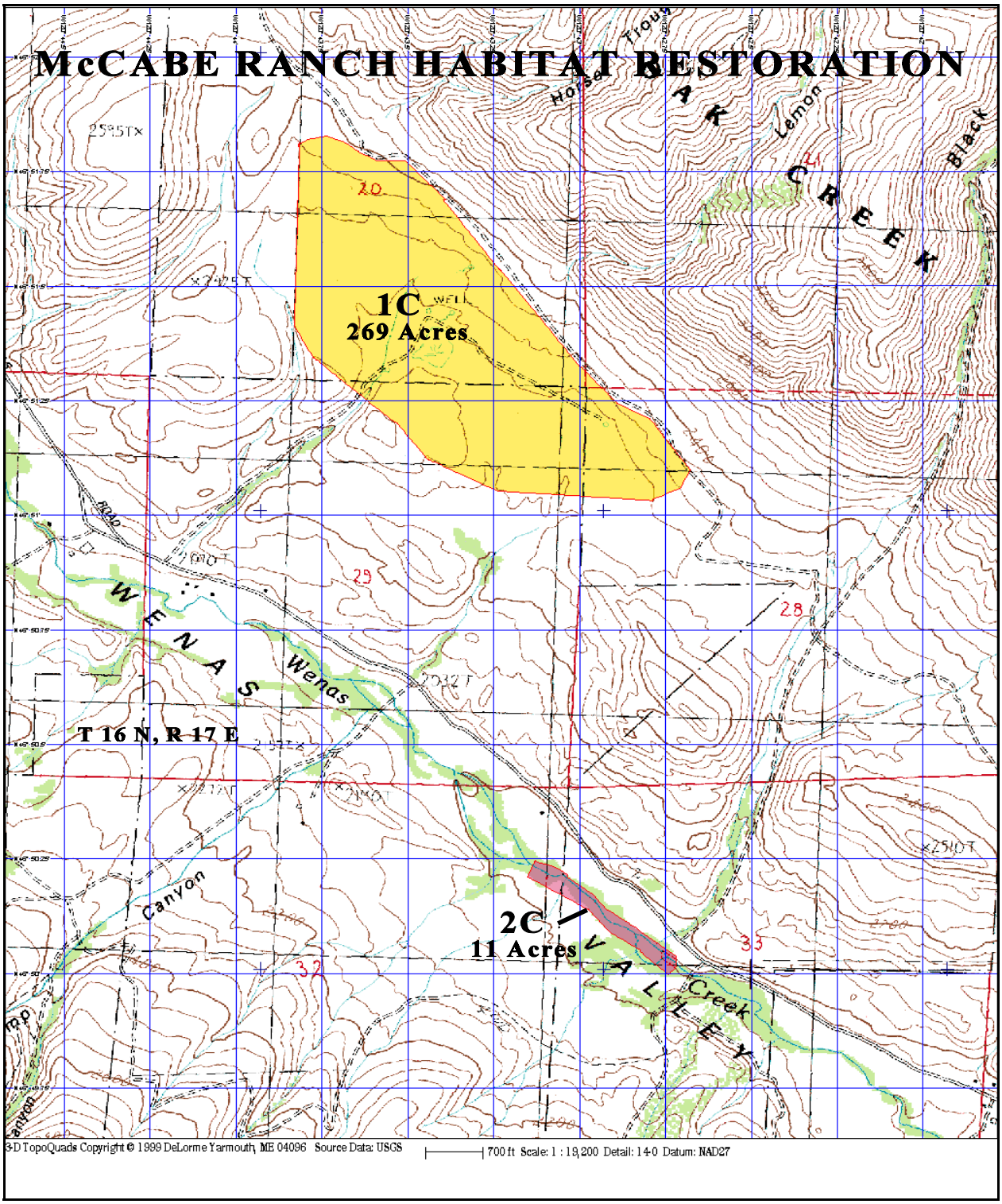


Figure 10. Location of McCabe enhancement and biological weed control agent release site.

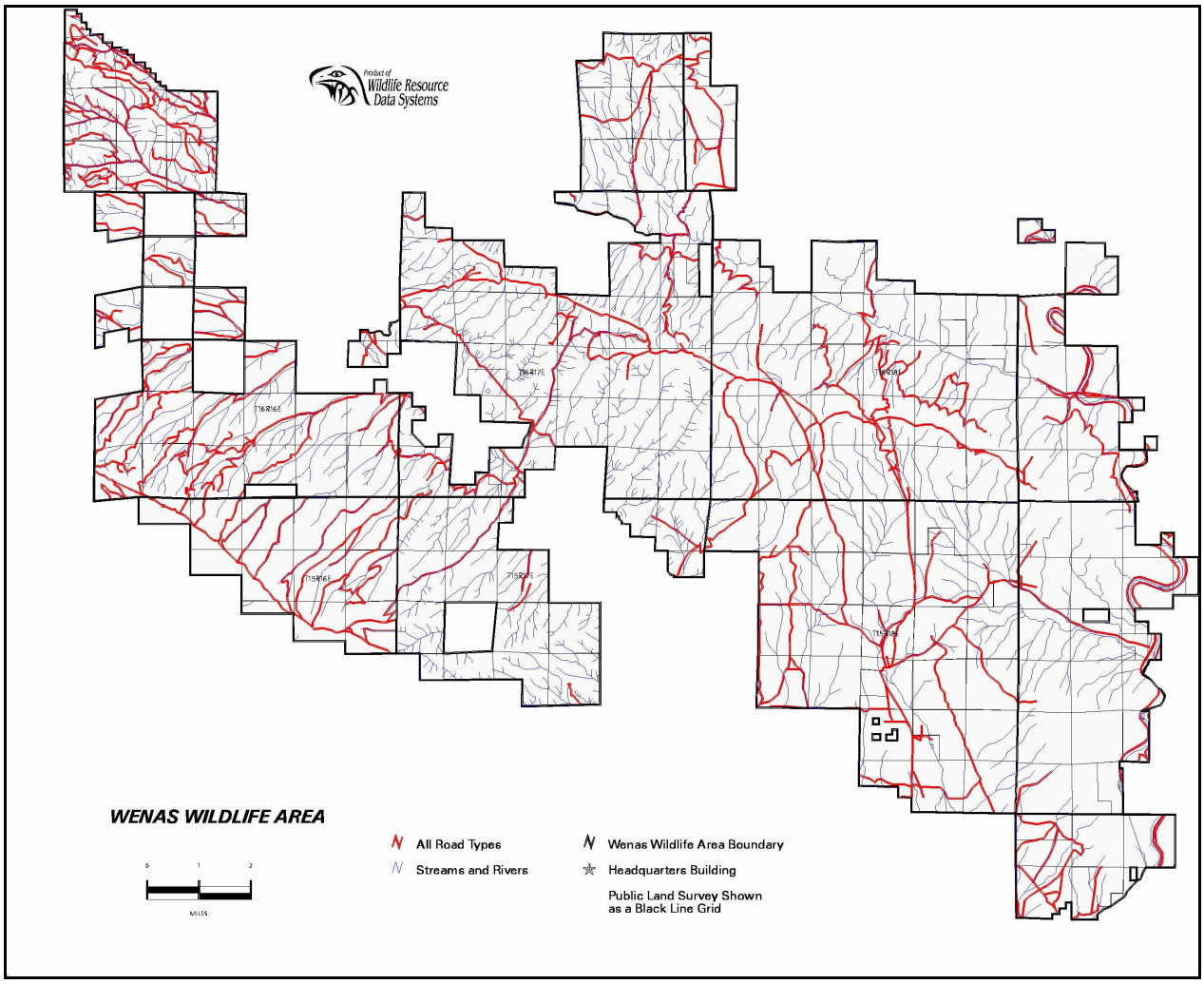


Figure 11. Roads requiring weed control activities on the Wenas Wildlife Area.

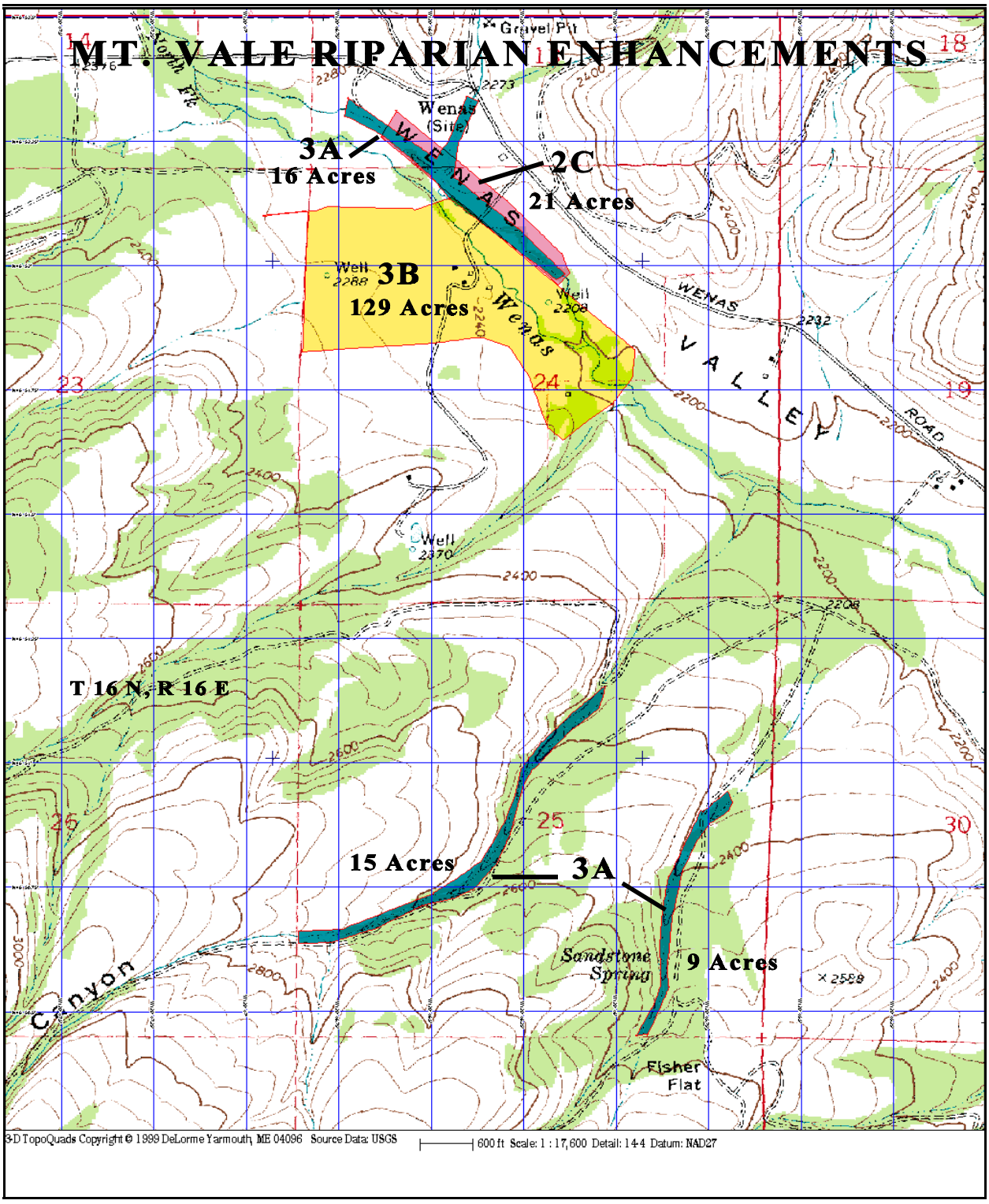


Figure 12. Mt. Vale Ranch and Clemans Mountain enhancements.

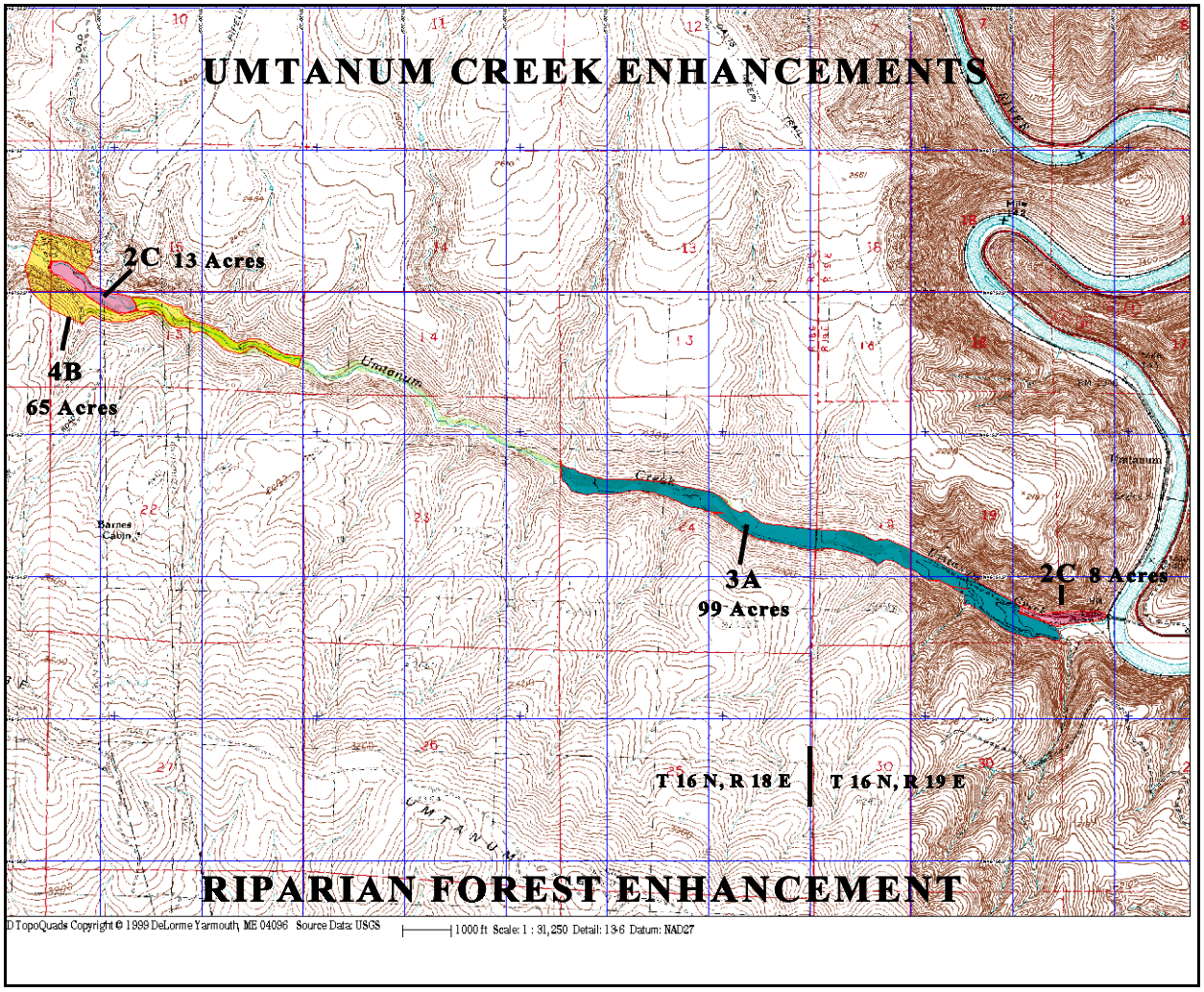


Figure 13. Umtanum Creek enhancements.

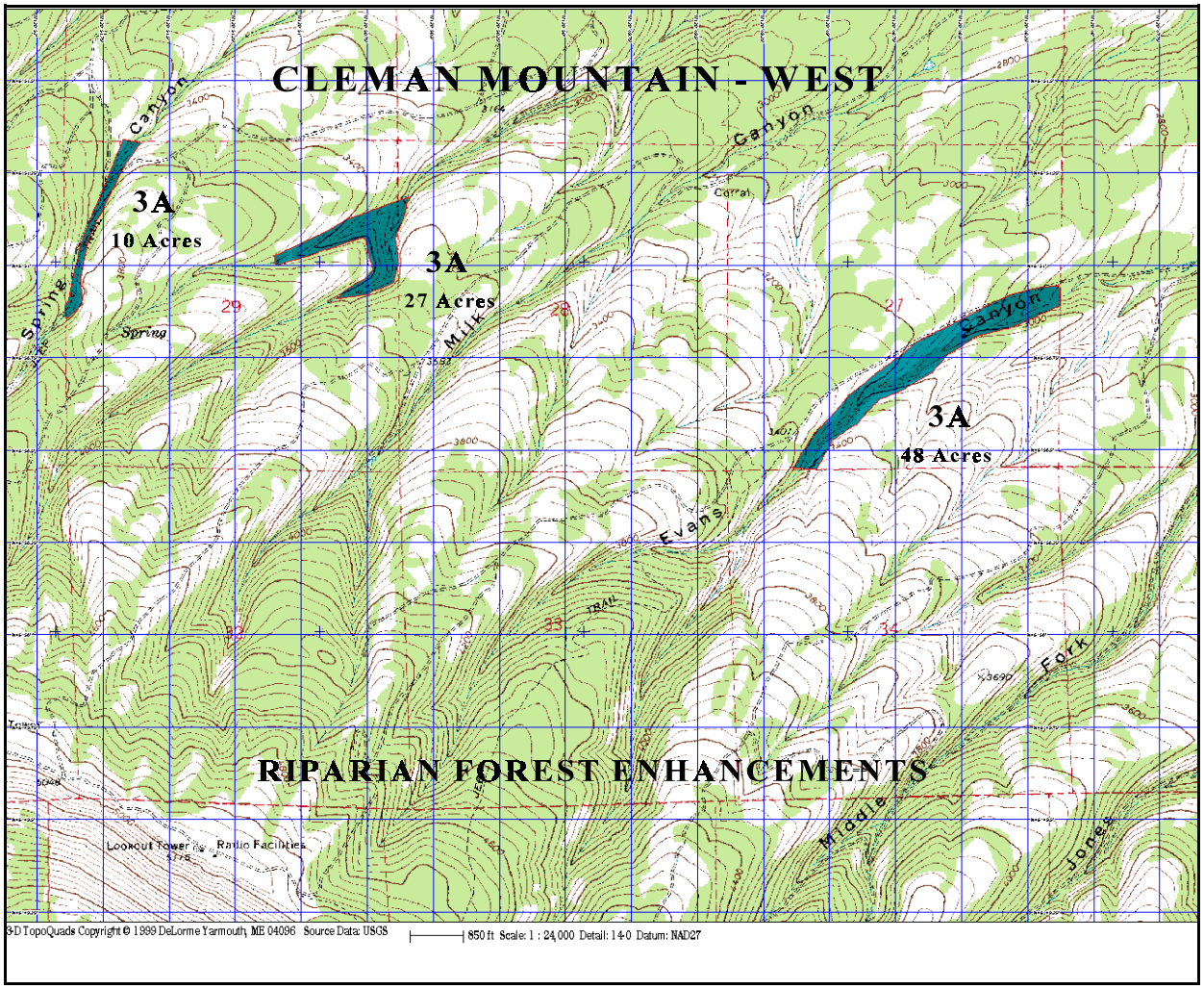


Figure 14. Cleman Mountain riparian forest enhancements.

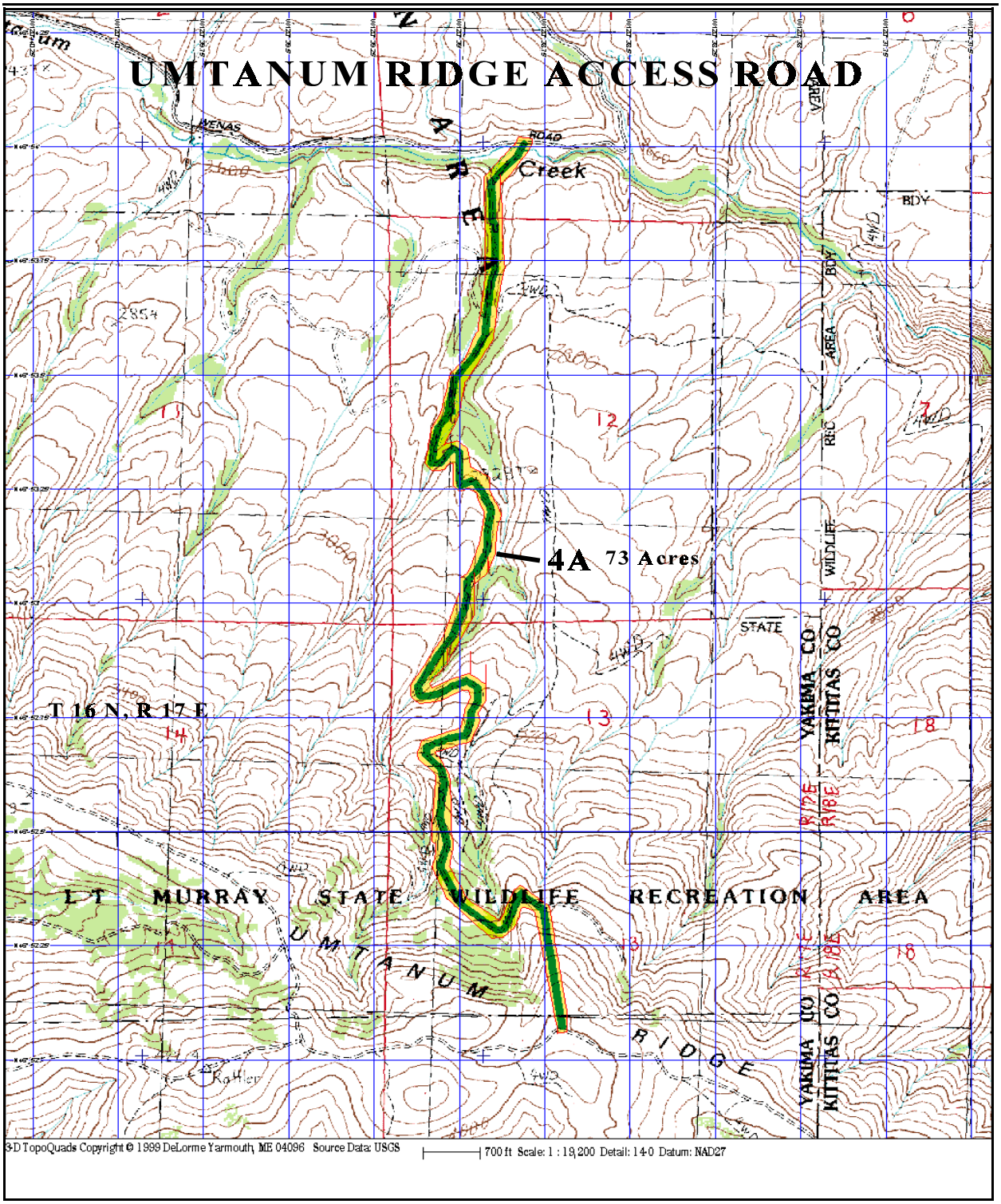


Figure 15. Umtanum Ridge access road enhancement location.

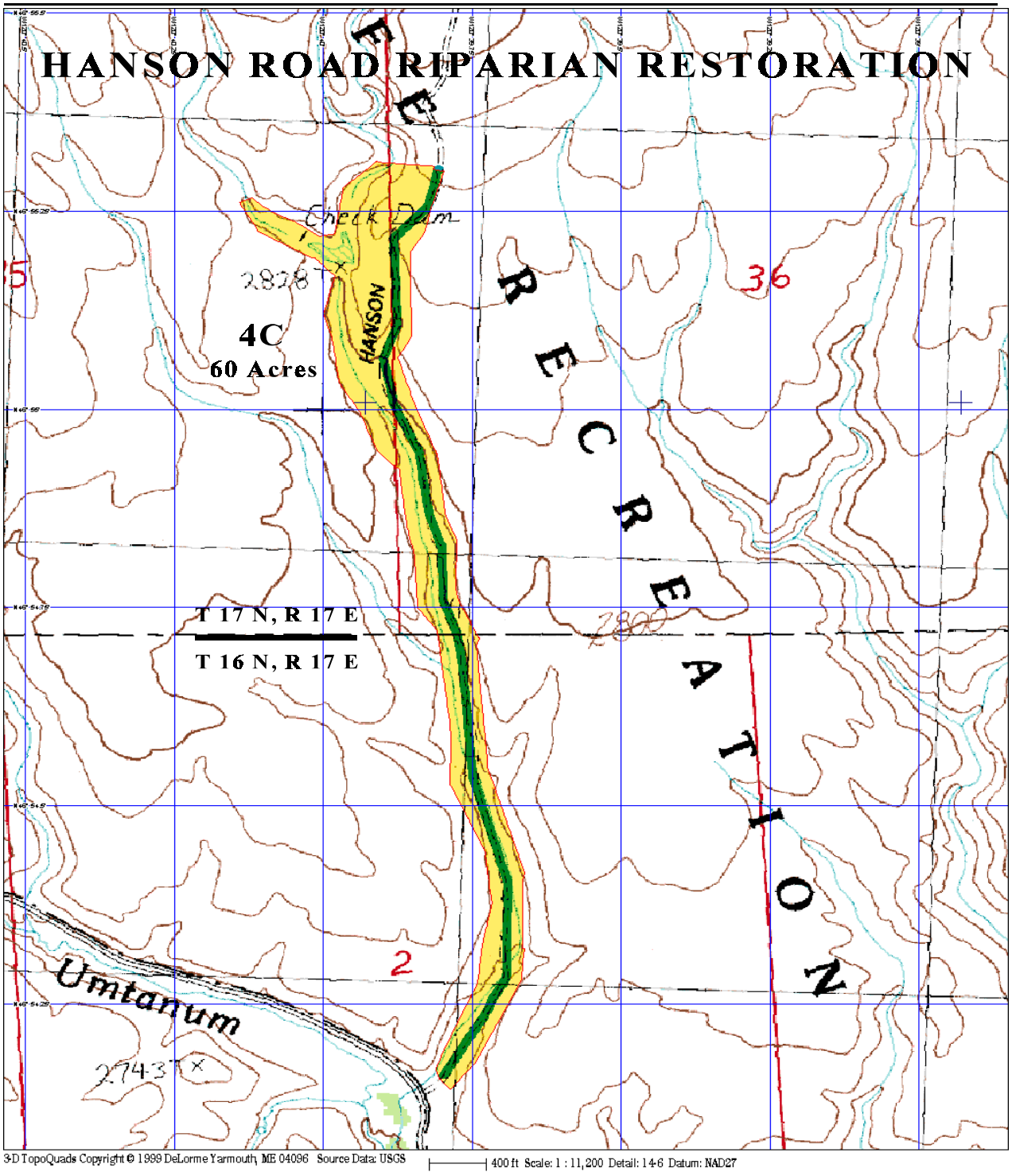


Figure 16. Hanson Road enhancement location map.

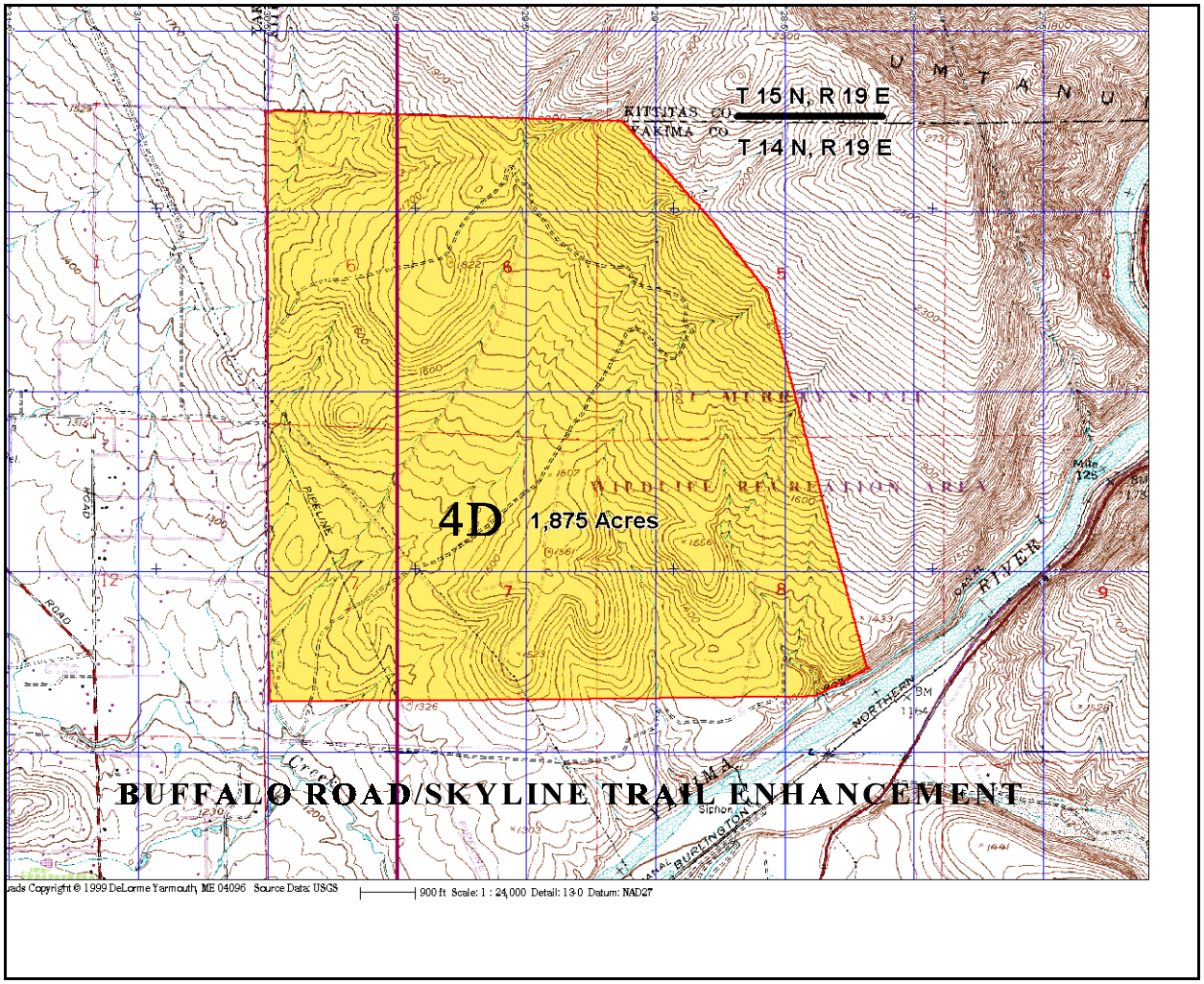


Figure 17. Buffalo Road/Skyline Trail enhancement location map.

CHAPTER V. C. Enhancement, Start-up, and Operation and Maintenance Costs.

Proposed enhancement costs and implementation schedules are described in Table 43. Costs include materials, supplies, equipment rental, and contracted services. Implementation time-lines are tentative and will be modified as required.

As of May 1, 2000, the Rocky Mountain Elk Foundation (RMEF) has contributed $119,000 towards enhancements on the Wenas Wildlife Area. Approximately $12,000 was spent on the Roza Creek restoration project, $88,000 was used to replant grasslands at Cottonwood Creek, and $19,000 was spent restoring habitat at the McCabe Ranch.

Table 43. Wenas WA enhancement activities and projected costs.

Designator	Enhancement Activity	Annual Cost					Total Cost
		FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	
1A	Roza Creek Restoration	$3,000	$33,000	$18,000	$0	$0	$54,000
1B	Cottonwood Creek Restoation	$2,000	$45,000	$25,000	$0	$0	$72,000
1C	McCabe Restoration	$3,000	$7,000	$0	$0	$0	$10,000
1D	Sheep Co. Rd. Enhancement	$5,000	$40,000	$0	$0	$0	$45,000
2A	Road/Trail Weed Control	$5,000	$25,000	$15,500	$15,500	$16,000	$77,000
2B	Upland/trail Weed Control	$2,000	$8,000	$5,500	$5,500	$6,000	$27,000
2C	Biological Weed Control	$0	$15,000	$15,000	$15,000	$15,000	$60,000
2D	Weed Control Seedings	$2,000	$10,000	$7,000	$7,000	$5,000	$31,000
3A	Riparian Forest Enhancements	$0	$10,000	$5,000	$5,000	$5,000	$25,000
3B	Riparian Enhancements	$0	$10,000	$5,000	$5,000	$5,000	$25,000
4A	Umtanum Ridge Rd. Enh	$0	$16,000	$0	$0	$0	$16,000
4B	Umtanum Creek Crossing	$0	$0	$62,000	$0	$0	$62,000
4C	Hanson Rd. Rip. Restoration	$0	$16,000	$0	$0	$0	$16,000
4D	Buffalo Rd./Skyline Trail Enh.	$0	$11,000	$0	$0	$0	$11,000
4E	Road Abandonment/repairs	$0	$105,000	$105,000	$70,000	$70,000	$350,000
	Total Enhancement Expenditures:	$22,000	$351,000	$263,000	$123,000	$122,000	$881,000

Start-up costs encompass crucial equipment needs that will be purchased on a one time basis during the enhancement implementation phase. Table 44 describes the items that have been acquired along with additional equipment requests.

Table 44. Wenas WA start-up equipment costs.

Equipment/Item	Percent	BPA Cost
Vehicle (Habitat Tech. 1)	100	$30,000
Cellular phones (2)	100	$200
Radio (Habitat Tech. 1 vehicle)	100	$3,000
Binoculars (purchased)	100	$0
Computer (purchased)	100	$0
Digital Camera	60	$300
Computer Printer/Fax/Scanner	100	$400
GPS Units (2)	100	$500
Misc. hand tools/backpack sprayers etc.	100	$2,000
4wheel ATV (purchased)	100	$0
Spray vehicle, tank, and attachments	100	$30,000
Chainsaw (2)	100	$800
Raingear, coveralls, and protective clothing	100	$250
Facility Maintenance	100	$5,000
Tractor	100	$50,000
Cultipacker (to be shared by all mitigation projects)	100	$9,000
Rotary mower	100	$6,000
Replace roof on Assistant Manager’s residence	100	$7,000
Repair bathroom in Assistant Manager’s residence	100	$1,000
Storage Building (5 bays)	100	$84,000
Total:		$229,450

Operations and maintenance tasks and costs are described on Table 45. In addition to basic O&M tasks and requirements, personnel costs for all tasks (including enhancements) are listed on this table. Annual DNR lease fees and fire control payments are also included.

Table 45. Operations and maintenance activities and budget.

Operations and Maintenance Activities	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	TOTAL
Personnel Salaries and Benefits						
Wildlife Bio. 3 (12 months) (WLA Manager) 60%	$37,200	$37,200	$37,200	$37,200	$37,200	$186,000
Wildlife Bio. 4 (01 month) (M&E/Vegetation Management Team)	$5,500	$5,500	$5,500	$5,500	$5,500	$27,500
Habitat Technician 2 (9 months)[32]	$29,250	$29,250	$29,250	$29,250	$29,250	$146,250
Habitat Technician 1 (9 months)[33]	$25,650	$25,650	$25,650	$25,650	$25,650	$128,250
WCC Supervisor (3 months)	$0	$9,525	$9,525	$9,525	$9,525	$38,100
WCC Crew (3 members x 3 months)	$0	$12,600	$12,600	$12,600	$12,600	$50,400
Agricultutural Consultant	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
Administration (postage, phone, maps, , radio fees etc)	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
Building maintenance and utilities[34]	$16,000	$16,000	$16,000	$16,000	$16,000	$80,000
Vehicle expenditures)	$12,000	$12,000	$12,000	$12,000	$12,000	$60,000
Equipment maintenance	$15,000	$15,000	$15,000	$15,000	$15,000	$75,000
Miscellaneous supplies, (fence, lumber, nails etc.)	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
Hand tools, backpack sprayers etc.	$1,000	$1,000	$1,000	$1,000	$1,000	$5,000
Contract herbicide applications/consultants	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
Replacement vehicles (4 wheeler and pick-up)	$0	$0	$10,000	$0	$30,000	$40,000
Clean-up and disposal fees	$3,000	$3,000	$3,000	$3,000	$3,000	$15,000
DNR lease fees[35]	$28,400	$28,400	$28,400	$28,400	$28,400	$142,000
DNR fire control contract[36]	$22,700	$22,700	$22,700	$22,700	$22,700	$113,500
Construct/maintain 25 miles of fire breaks	$0	$0	$0	$0	$0	$0

[32] The Hab. Tech. II is a 12 month position. BPA funds 9 months and WDFW funds 3 months (Weed Control/Winter Feeding funds).

[33] The Hab. Tech. I is a 12 month position. BPA funds 9 months and WDFW funds 3 months (Weed Control/Winter Feeding funds).

[34] Includes $1,000 annually for maintenance of the Assistant Manager's residence.

[35] Reflects current DNR lease fees. This contract will be re-negotiated in FY 2001. As a result, lease fees are subject to change.

[36] Pays only for fire suppression equipment and limited fire fighting personnel costs. Fire fighting costs above contract limits must be paid for with additional funds.

Operations and Maintenance Activities	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	TOTAL
Signs	$1,000	$500	$500	$500	$500	$3,000
Herbicides	$8,000	$8,000	$10,000	$15,000	$15,000	$56,000
Operations and Maintenance Totals:	$229,700	$251,325	$263,325	$258,325	$288,325	$1,291,000

Table 46. Legally required assessments, activities, and estimated costs.

Required Assessments and Activities	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	TOTAL
Property taxes/weed assessments	$57,200	$57,200	$57,200	$57,200	$57,200	$286,000
Employee Housing Rent	$6,000	$6,000	$6,000	$6,000	$6,000	$30,000
Winter feeding	$18,500	$18,500	$18,500	$18,500	$18,500	$92,500
Required Assessment Totals:	$81,700	$81,700	$81,700	$81,700	$81,700	$408,500

Table 47. Wenas WA enhancement, start-up, O&M, and assessment cost summary.

Activity	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	TOTAL
Total Enhancement Expenditures:	$22,000	$351,000	$263,000	$123,000	$122,000	$881,000
Operations and Maintenance Totals:	$275,750	$275,250	$287,250	$282,250	$312,250	$1,432,750
Start-up Costs Total:	$262,860	$0	$0	$0	$0	$262,860
Sub-total	$560,610	$626,250	$550,250	$405,250	$434,250	$2,576,610
Overhead (25.2%)[37]	$81,550	$157,815	$136,143	$102,123	$101,871	$579,502
Required Assessment Totals:	$81,700	$81,700	$81,700	$81,700	$81,700	$408,500
Project Totals:	$723,860	$865,765	$768,093	$589,073	$617,821	$3,564,612

Table 48. Project cost share summary.

Agency	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	TOTAL
BPA	$642,160	$784,065	$686,393	$507,373	$536,121	$3,156,112
WDFW	$81,700	$81,700	$81,700	$81,700	$81,700	$408,500
Project Totals:	$723,860	$865,765	$768,093	$589,073	$617,821	$3,564,612

[37] The rate is variable and is negotiated annually. Consequently, out-year costs will change.

CHAPTER VI. HABITAT EVALUATION PROCEDURE

CHAPTER VI. A. Habitat Evaluation Procedures Description

Habitat Evaluation Procedures is a method that was developed by the U. S. Fish and Wildlife Service (FWS) in the early 1970's to rate the quality and quantity of habitat. HEP may be used to quantify the impacts of changes made through land and water development projects[38]. HEP is used to document baseline information on habitats as a gauge for future habitat modifications. HEP is also a planning tool used in project planning, impact assessment, compensation, and habitat management by providing information for the relative value of an area at different points in time.

The basic currency of HEP is the Habitat Unit (HU). It is the value of an area to a particular species of wildlife, and is a product of the size of the suitable area for the species times the quality of the area for the species. In HEP, the quantity part of the formula is any measure of area (e.g., acres, hectares, square miles, or sections) which is appropriately sized for the particular study. The quality measurement of the formula is expressed in the form of a Habitat Suitability Index (HSI), which varies from zero to one, and measures how suitable the habitat is for the particular species when compared to optimum habitat. The product of these two measures is a HABITAT UNIT or HU. In HEP our measure of habitat value can be stated as:

HABITAT UNIT = AREA X HABITAT SUITABILITY INDEX
or
HU = AREA X HSI

CHAPTER VI. B. Habitat Evaluation Procedure Methods

General

The Northwest Power Planning Council (NPPC) adopted HEP as the protocol to measure habitat losses and gains resulting from construction of hydro power facilities on the Columbia River and subsequent destruction of habitat when reservoirs were filled. Species models representing habitat losses associated with Grand Coulee, John Day, and McNary Dams were selected to evaluate habitat conditions and cover types on the Wenas Wildlife Area (Table 49). Species model habitat attributes (variables) evaluated by WDFW's HEP team are listed on Tables 50 through 55.

[38] Habitat Evaluation Procedures Workbook., National Biological Services, Fort Collins, Colorado, 1995.

Table 49. Species models, cover types, and justification for model selection.

Species Model(s)	Cover Type	Rationale
Sage grouse[39]/mule deer[40]	Shrublands	Sage grouse are a State/Federal Priority species (T&E) while mule deer are an important big game species. Models measure shrub diversity, herbaceous cover quality, and anthropogenic factors and are indicator species for shrub-steppe.
Sage grouse/mule deer	Disturbed shrublands	Same as above
Sage grouse/western meadowlark[41]	Grasslands	Models measure shrub composition/cover and grass and forb components. Both are indicator species for grassland/shrub-steppe. The meadowlark model is sensitive to changes in grass, forb, and shrub cover/composition.
Sage grouse/western meadowlark	CRP grasslands	Same as above
Black-capped chickadee	Conifer/riparian forest	The model measures number of snags ≥4" DBH[42]/acre and tree canopy and height.
Yellow warbler	Riparian shrub	This model measures shrub height, percent cover, and percent hydrophytic shrubs.
Mink	Riverine	The mink model considers shoreline cover, cover within 100 meters of the shoreline, and water regime.

[39] Ashley, Paul R. 1998. Draft Sage Grouse Model. WDFW , Olympia, Washington. 5 pp.

[40] Ashley, P.R., and Matt T. Berger. 1999. Habitat Suitability Model for Mule Deer (winter). Bonneville Power Administration/Northwest Power Planning Council, Portland, Oregon. 34 pp.

[41] *(Sturnella neglecta)*; Model modified from Schroeder and Sousa. 1982. USFWS.

[42] Diameter Breast Height (4.5 feet).

Table 50. HEP model variables.

Model	Variable	Description
Sage Grouse	V1	Percent sagebrush cover (mean)
	V2	Mean sagebrush height
	V3	Shrub species
	V4	Topography
	V5	Aspect
	V6	Size of wintering area
	V7	Percent grass cover (includes residual vegetation)
	V8	Percent forb cover (includes residual vegetation)
	V9	Mean height herbaceous/residual vegetation
	V10	Percent shrub cover (mean)
	V11	Mean shrub height
	V12	Percent slope
	V13	Visual obstruction reading (VOR) for general area
	V14	Percent of area with VOR $\geq$2 decimeters
	V15	Percent cover comprised of exotic vegetation
HSI Equation		Winter: $(V1 \times V2 \times V3 \times V4 \times V5)^{1/5} \times V6$; Nesting: $(V7 \times V8 \times V9 \times V10 \times V11 \times V12)^{1/6} \times (V13 \times V14)^{1/2} \times V15$

Table 51. HEP model variables.

Model	Variable	Description
Western meadowlark	V1	Percent cover of herbaceous plants
	V2	Percent of herbaceous cover composed of grass
	V3	Average height of herbaceous cover
	V4	Distance to perch sites
	V5	Percent shrub cover
HSI Equation		$(V1 \times V2 \times V3 \times V4)^{½} \times V5$

Table 52. HEP model variables.

	Variable	Description
Winter Mule Deer	V1	Percent cover preferred shrubs ≤1.5 meters in height
	V2	Number of preferred shrub species
	V3	Mean shrub height
	V4	Percent cover of all shrubs ≤1.5 meters in height
	V5	Percent cover of palatable herbaceous species
	V6	Presence of suitable agricultural crops within 1.6k of study area
	V7	Aspect
	V8	Road density
	V9	Topographic diversity
	V10	Percent evergreen canopy ≥1.5 meters in height
HSI Equation		Winter Food Index: $(((V1 (V2 \times V3 \times V4 \times V5)^{1/4}) + V6) \times V7)^{\wedge.625} \times V8$ Winter Cover Index: (V9 + 2(V10))/3; The HSI is the lower value between Winter Food and Winter Cover.

Table 53. HEP model variables.

	Variable	Description
Black-capped Chickadee	V1	Percent tree canopy close
	V2	Average height of overstory trees
	V3	Tree canopy volume (not used)
	V4	Number of snags 10 to 25 cm DBH/ha (4 to 10 inches DBH/acre
HSI Equation		Lower Value - Food: $(V1 \times V2)^{1/2}$, or Reproduction: V4

Table 54. HEP model variables.

Model	Variable	Description
Yellow Warbler	V1	Percent deciduous shrub crown cover
	V2	Average height of deciduous shrub canopy
	V3	Percent of deciduous shrub canopy comprised of hydrophytic shrubs
HSI Equation		$(V1 \times V2 \times V3)^{1/2}$

Table 55. HEP model variables.

Model	Variable	Description
Mink[43]	V1	Percent of year with surface water present
	V5	Percent canopy cover of trees and shrubs within 100 meters of the wetland's edge
	V6	Percent shoreline cover within 1 meter of the water's edge
HSI Equation		V1 or $(V5 \times V6)^{½}$ whichever is lower

[43] Not all Model variables are used to determine the HSI for the riverine cover type.

Methods

The HEP Team's primary sampling objective was to determine baseline habitat conditions on a representative sample of all cover types, occurring on the Wenas Wildlife Area, by the end of FY 1999. As previously stated, shrubland cover types and grassland cover types were combined to simplify cover type mapping and document results. A total of sixty-seven transects were established totaling more than 24.5 kilometers or15.32 miles (Appendix B).

In order to learn as much as possible about the Unit's present vegetation community and ecological condition, WDFW HEP team members sampled vegetation at a greater intensity than required to obtain data just for HEP model purposes. This data will be used to establish base line conditions for future habitat monitoring and evaluation surveys and replication of HEP transects. The following HEP/vegetation sampling protocol was used to typify and describe current habitat conditions on the Wenas Wildlife Area.

Sampling Protocol

Field cover type maps were developed from aerial photographs and NRCS Yakima/Kittitas soils data superimposed on USGS Topographic maps (1:24,000 scale). The preliminary maps were ground truthed and modified as needed. A finalized GIS version of the cover type map is shown in Figure 4.

Transect starting points and azimuths (direction) were randomly selected for each cover type and recorded on data sheets along with transect identification, cover type, HEP Team, and global positioning system (GPS) information. If possible, transects were established at least 100 yards from ecotones, roads, and other anthropogenic influences.

Transect start and end points were marked with a 14 inch long ¼ inch rebar stake painted flourescent orange or red. GPS positions were also taken at both start and end points. If cover types changed, either another transect azimuth was randomly selected, or the original azimuth was varied by 45 degrees. The method selected was based on which technique kept the transect within the cover type. Compass azimuths (headings) were also corrected for local declination (21 degrees east).

Shrubland transects ranged from 400 to 3,000 feet in length and were divided into 100 foot sampling units. Similarly, grassland transects ranged from 600 to 2,000 feet in length and were also divided into 100 foot sampling units (n).

The process for determining transect length (sample size) varied based on what variable was being measured. In general, a "running mean" was used to estimate variance on cover pole readings (95% probability of being within ± 10 percent of the true mean). On the other hand, shrub cover sample size was estimated by first tallying total shrub cover within each 100 foot sampling unit and dividing that sum by sample unit length to obtain percent shrub cover per sample unit (i.e., 10 feet of cover/100

feet = 10 percent shrub cover). The standard deviation was then calculated from the percent shrub cover data for each sample unit. The sample size was determined through use of the following equation:

$$n = \frac{t^2 s^2}{B^2}$$

where: t = t value at the 95 percent (0.05) confidence interval for the appropriate degrees of freedom (*df*); s = standard deviation; and B = bounds (± 10 percent). The same equation was used to determine sample size for plot frames based on total percent cover for herbaceous species.

Habitat variables and measurement techniques are described in Table 56. Additional information can be found in Estimating Wildlife Habitat Variables (1981).[44]

Table 56. HEP transect variables and measurement techniques.

Variable	Measurement Technique
Percent sagebrush cover (mean)	Line intercept
Mean sagebrush height	Graduated rod/tape measure
Shrub species	Ocular identification
Topography/topographic diversity	Topographic map/GIS map
Aspect	Compass/topographic map
Size of wintering area	Aerial photograph/GIS map
Percent grass cover (includes residual vegetation)	½ square meter rectangle plot frame (0.5x1.0 meter)
Percent forb cover (includes residual vegetation)	½ square meter rectangle plot frame (0.5x1.0 meter)
Mean height herbaceous/residual vegetation	Tape measure
Percent shrub cover (mean)	Line intercept
Mean shrub height	Graduated rod/tape measure
Percent slope	Clinometer/topographic map

[44] Estimating Wildlife Habitat Variables, FWS/OBS-81/47, U.S. Department of the Interior, Washington, D.C., 1981, 111 pps.

Visual obstruction reading (VOR) for general area	Robel pole[45] (cover pole)
Percent of area with VOR ≥2 decimeters	Robel pole
Percent herbaceous plant cover	½ square meter rectangle plot frame (0.5x1.0 meter)
Percent herbaceous cover composed of grass	½ square meter rectangle plot frame (0.5x1.0 meter)
Distance to perch sites	Estimated/tape measure
Percent cover preferred/all shrubs ≤1.5 meters	Line intercept
Number of preferred shrub species	Line intercept/direct count
Presence of agricultural crops	Aerial photographs/direct observation
Road density	Topographic/county maps
Percent evergreen canopy ≥1.5 meters in height	Line intercept

All measurements were taken from the same transect line. Shrub cover data was obtained from line intercept measurements while herbaceous cover was determined using rectangular plot frames. Transect protocol is described below.

1. Establish transect starting point 300 feet within cover type (if possible). Record shrub intercept in 10ths of feet by shrub species for each sampling unit (100 foot segments) for entire transect length. Using a graduated rod, measure shrub height (10ths of feet) at the highest point where shrub foliage/stems intercept transect line.

2. Facing line of travel (transect azimuth), walk on left side of transect line to avoid trampling vegetation on both sides of transect. Place first rectangular plot frame at the 25 foot mark and at 25 foot intervals thereafter (four per 100 foot sampling unit). Place the lower right hand corner of the plot frame on the 25 foot interval mark on the right side of the transect line with the long axis of the plot frame perpendicular to the transect line of travel. Make ocular estimates of: herbaceous cover by plant species, percent of plot comprised of total herbaceous cover, and percent of herbaceous cover composed of grass (based on Daubenmire's technique described in Steppe Vegetation of Washington (1970).

[45] Robel, R.J.; J. N..; Dayton, A.D.; Hulbert, L. C. Relationship between visual obstruction measurements and weight of grassland vegetation**.** Journal of Range Managemnent. 23: 295.

3. Measure height of herbaceous cover by species in each plot frame with a graduated rod/tape measure (10ths of feet).

4. Take two Robel pole measurements per sampling unit i.e., one at the 50 foot mark and the other at the 100 foot interval. Four observations were taken and averaged per point to obtain a single visual obstruction reading or VOR (two measurements are taken four meters from the point on the transect line on opposite sides of the cover pole from a height of one meter; two measurements are taken from the point perpendicular to the transect line of travel).

Forest and riparian cover type protocols are identical to those described for shrubland/grassland transects with the exception of VOR which is not needed. In addition to shrub and herbaceous cover data, snag and/or tree basal area information is collected from within tenth acre (0.10) circular plots located at 100 foot intervals along each transect. Tree canopy cover is determined using a densitometer (similar to a moose horn) at 10 foot intervals (10 per 100 foot sampling unit; 100 per 1,000 foot transect). Diameter breast height (DBH) measurements were taken on some forest and riparian forest transects.

CHAPTER VI. C. Habitat Evaluation Procedure Results

Background

In HEP, species model habitat suitability indices range from 0.0 to 1.0 (poor to optimum respectively). Mathematical HSI scores are compared to verbal equivalents in Table 57.

Table 57. Comparison of mathematical HSI scores and equivalent verbal expressions.

Habitat Suitability Index (HSI)	Verbal Equivalent
0.0 < 0.2	Poor
0.2 < 0.4	Marginal
0.4 < 0.6	Fair
0.6 ≤ 0.9	Good
0.9 to 1.0	Optimum

The following assumptions were made during this HEP analysis.

1. Baseline HUs on project lands owned by WDFW will decrease without mitigation funds to enhance and maintain these areas.
2. BPA receives full credit for enhancements and limited protection credit on lands owned by WDFW and BLM.
3. BPA receives full credit for acquisitions (protection and enhancement credit) and DNR lands leased with BPA funds.

Wenas Wildlife Area HEP survey results are summarized on Table 58. Habitat units reflect only baseline (TY 0 HUs). Furthermore, HU credit associated with forest canopy (trees)on lands owned by DNR is not allowed because DNR retained control over the "timber rights."

Table 58. Wenas Wildlife Area pre-relative value index baseline habitat unit summary.

Cover Type	Acres	Species	Habitat Units
Grassland	69,582	Western Meadowlark	12,240
Shrubland	17,455	Mule Deer	2,611
		Sage Grouse	1,623
Riparian Forest	1,213	Black-capped Chickadee	389
Riparian Shrub	379	Yellow Warbler	84
Riverine	168	Mink	17
Woodland Forest	9,861	Mule Deer	801
Medium Conifer Forest	4,443	Mule Deer	731
Dense Conifer Forest	2,110	Mule Deer	45
TOTAL	105,221	All Species	18,541

The Wenas Wildlife Area is an off-site compensation project credited against losses incurred at Grand Coulee, McNary, and John Day Dams. As a result, a Relative Value Index (RVI) process was used to credit dissimilar species models (species within guilds) against like cover types. Total credits, including RVI derived habitat units, for the Wenas Wildlife Area equal 22,447 habitat units. Relative Value habitat unit summaries are located in Attachment 4. The RVI process is summarized below.

Relative Value Index Description

Wildlife managers and resource planners must often compare alternative proposed actions that result in HU changes for different evaluation species. Likewise, the perceived relative value of different cover types by resource managers may place more importance on one cover type over another for mitigation/compensation purposes. For example, if an agency's priority resource management goal is to protect and enhance cottonwood galleries for obligate wildlife species, 500 mallard HUs gained from creating a 1,000 acre open water reservoir may not be as valuable to wildlife managers as 75 beaver HUs representing 125 acres of lost deciduous forest comprised of cottonwood trees. In this example, mallards are not a priority species and there is more than enough suitable mallard winter habitat to support resident and migratory mallard populations, but only fragmented remnants of cottonwood stands remain post project. To suggest that 500 open water HUs more than compensates for 75 deciduous forest HUs in dissimilar cover types is not supported by biological fact. Similarly, different wildlife species within guilds may be used to represent like cover types in different geographical areas. For example, California quail and sage grouse were used to represent wildlife species associated with shrub-steppe habitat near John Day and Coulee Dams respectively. As a result, resource managers developed a methodology to address these issues and document value judgements made during a trade-off analysis. This led to development of a Relative Value Index.

The Relative Value Index, a trade-off decision, must be based on resource management goals, administrative policy, or both. Management goals for different wildlife species can be incorporated and evaluated through the use of RVIs. In practice, RVIs are applied as weighting values to HUs calculated for each evaluation species/cover type. These weighing values are determined by a user-defined set of socio-economic and ecological criteria (for specific information on how to develop an RVI, review Ecological Services Manuals 101, 102, 103, Division of Ecological Services, Washington, D.C., U.S. Department of the Interior. 1980).

General

The following tables and paragraphs are based on HEP model outputs for each Unit and are applied to the entire area represented by a cover type regardless of ownership. HEP results are depicted in Tables with discussions limited to habitat suitability index (HSI) ratings below 0.4 (fair). Abbreviated HEP models are included in Attachment 3.

It is possible that "micro" sites within a cover type may be better habitat than suggested by model outputs. Conversely, it is equally likely that some areas may be poorer habitat quality for a given

species. Overall, however, HSI ratings reflect general habitat quality within the Unit. Planned habitat enhancement and protection activities take into account HEP survey results for target wildlife species.

Table 59. South Umtanum Ridge Unit HEP results.

Cover Type	HEP Model	HSI	Verbal Equivalent
Grassland	Western Meadowlark	0.44	Fair
Disturbed Grassland	Western Meadowlark	0.60	Good
Dense Shrubland	Sage Grouse	0.12	Poor
Dense Shrubland	Mule Deer	0.59	Fair
Conifer Forest Woodland	Mule Deer	0.22	Marginal
Medium Conifer Forest	Mule Deer	0.43	Fair
Riparian Shrub	Yellow Warbler	0.81	Good
Riverine	Mink	0.72	Good

Discussion

The dense shrubland cover type provides “poor” habitat for sage grouse due to the poor quality of herbaceous nesting cover as reflected by low Robel pole values . In contrast, mule deer habitat was rated marginal within conifer forest woodlands due to the lack of preferred shrub species and low shrub height within this cover type.

Table 60. Umtanum Creek Unit HEP results.

Cover Type	HEP Model	HSI	Verbal Equivalent
Grassland	Western Meadowlark	0.46	Fair
Dense Shrubland	Sage Grouse	0.20	Marginal
Dense Shrubland	Mule Deer	0.38	Marginal
Conifer Forest Woodland	Mule Deer	0.17	Poor
Medium Conifer Forest	Mule Deer	0.33	Marginal
Riparian Forest	Black-capped Chickadee	0.92	Optimum
Riparian Shrub	Yellow Warbler	0.81	Good
Riverine	Mink	0.72	Good

Discussion

The dense shrubland cover type provides "poor" habitat for sage grouse due to the lack of sagebrush required for winter forage. Conifer forest woodland was rated as poor mule deer habitat as a result of low quantities of preferred forage shrub species and the general lack of shrub understory. Likewise, the Mule deer HSI was marginal within the medium conifer forest cover type primarily due to low amounts of preferred shrub browse species.

Table 61. Roza Creek Unit HEP results.

Cover Type	HEP Model	HSI	Verbal Equivalent
Grassland	Western Meadowlark	0.36	Marginal
Dense Shrubland	Sage Grouse	0.37	Marginal
Dense Shrubland	Mule Deer	0.32	Marginal
Riparian Forest	Black-capped Chickadee	0.25	Marginal
Riparian Shrub	Yellow Warbler	0.81	Good
Riverine	Mink	0.72	Good

Discussion

The overall HSI for western meadowlark was marginal within the grassland cover type because of the lack of herbaceous cover on shallow lithisol(s) soil types (in contrast the HSI on just the "grassland" portion of the cover type was rated as "good"). Like other Units, sage grouse habitat within the dense shrubland cover type is marginal due to low visual obstruction readings (VOR) of available nesting cover. Winter mule deer habitat, in contrast, is marginal due primarily to low shrub diversity/height and general landscape aspect (aspect is an important consideration within the winter mule deer model). The riparian forest cover type (black-capped chickadee habitat) is marginal due to low tree canopy closure and the lack of large snags.

Table 62. North Cleman Mountain Unit HEP results.

Cover Type	HEP Model	HSI	Verbal Equivalent
Grassland	Western Meadowlark	0.40	Fair
Shrubland	Mule Deer	0.28	Marginal
Conifer Forest Woodland	Mule Deer	0.15	Poor
Medium Conifer Forest	Mule Deer	0.26	Marginal
Dense Conifer Forest	Mule Deer	0.04	Poor
Riparian Forest	Black-capped Chickadee	0.92	Optimum

Discussion

Winter mule deer habitat within the shrubland and conifer forest cover types is rated poor to marginal due mainly to low percent cover of preferred shrub forage species and the general aspect of the Unit (north aspects are less desirable than south aspects because of low solar radiation during winter months). In addition, snow depth is usually greater and remains longer on north slopes.

CHAPTER VII. MONITORING AND EVALUATION

CHAPTER VII. A. Monitoring and Evaluation

Background

Monitoring is a tool for detecting change and identifying problems in the early stages before they become obvious or a crises. If detected early, problems can be addressed while cost effective solutions are still available. For example, an invasive weed species is much easier to eradicate/control at the initial stages than attempting to eradicate it once established. Monitoring is also critical for measuring management success. Good monitoring can demonstrate that management strategies are

working and provide evidence supporting the continuation of management. Conversely, monitoring can also show a need to change current management strategies.

Monitoring is a key component of "adaptive management," in which monitoring measures progress towards or away from meeting management goals and objectives and provides evidence to continue or change current management strategies.[46] In practice, most monitoring measures change or condition of the resource whether it is a plant community, or a wildlife species. If objectives are being met, management is considered effective.

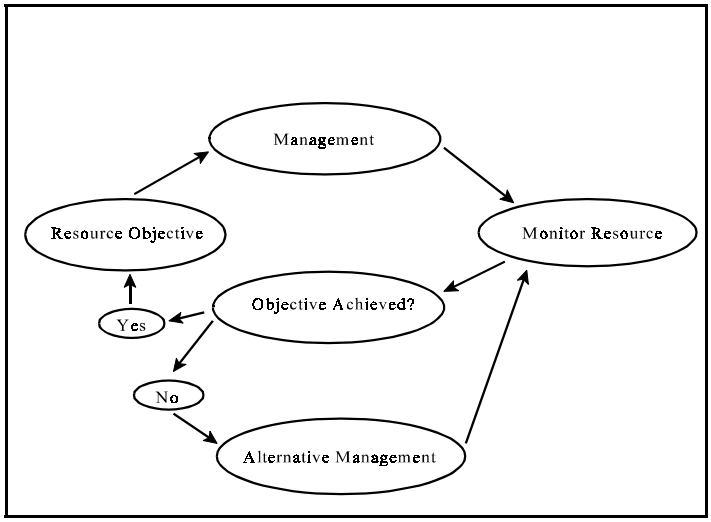


Figure 18. The adaptive management cycle. Note that monitoring provides the link between objectives and adaptive management.

The adaptive management cycle, illustrated in Figure 18, consists of four basic steps.

1. Resource objectives are developed to describe the desired condition.
2. Management is designed to meet the objectives, or existing management is continued.
3. The response of the resource is monitored to determine if the management objective has been met.
4. Management is adapted (changed) if objectives are not reached.

Monitoring, as part of the adaptive management cycle, has two primary components. The first is that

[46] Ringold, P.L.; Czaplewiski, R.L.; Mulder, B.S.; Tolle, T.; Burnett, K.1996. Adaptive monitoring design for ecosystem management. Ecological Applications 6 (3): 745-757.

monitoring is driven by management objectives. What is measured, how it is measured, and how often it is measured are defined by how an objective is described. The objective describes the desired condition. Management is designed to meet the objective. Monitoring is designed to determine if the objective is met. Objectives form the foundation of the project.

The second component is that monitoring is only initiated if opportunities for management change exist. If no alternative management options are available, expending resources to monitor something is almost futile. For example, since vegetation management (with exception of weed control measures) on shallow lithosols soils is impractical, it is not wise to use limited monitoring resources on these areas (this does not preclude general plant community inventories). In such cases, monitoring resources should be directed towards opportunities where management solutions are available.

Measuring change over time is the main characteristic of monitoring, but change can be measured as trend studies, baseline studies, long term ecological studies, and inventories as well. Monitoring on the Wenas Wildlife Area will be tied to management objectives and will include plant community surveys similar to those conducted in conjunction with the baseline HEP analysis .

Basic monitoring on the Wenas WA will be accomplished by WA staff , Vegetation Management Team personnel, and volunteers on a periodic basis. M&E protocols and techniques are subject to change as new information becomes available. The following four monitoring surveys will be conducted:

1. HEP surveys (five year intervals)
2. General cover type/vegetation surveys (five year intervals)
3. Site specific enhancement and maintenance activity surveys (one to five year intervals)
4. Wildlife species response/trend surveys (one to three year intervals)

Monitoring falls under two general categories i.e., habitat monitoring and resource monitoring. Replicating HEP surveys is an example of habitat monitoring which describes how well an activity meets the objectives or management standards for a particular cover/habitat type. “Optimum” (1.0) habitat suitability for each HEP model variable is the standard against which the effectiveness of management is measured.

In contrast, resource monitoring focuses on vegetation and/or wildlife and describes some aspect such as height, percent cover, density, frequency, population characteristics, and/or species response. Both general cover type/vegetation surveys and monitoring of site specific enhancement and maintenance activities are examples of resource monitoring.

Wildlife population and species response surveys will be conducted by WWA staff, WDFW wildlife biologists, and volunteers where appropriate. Monitoring includes both mammal and bird surveys.

CHAPTER VII. B. Specific Monitoring and Evaluation Protocol

The primary concept behind establishing M&E transects is to detect change. Permanent transects are recommended over temporary transects because the statistical tests for detecting change from one period to the next in permanent sampling units are much more powerful than on temporary sampling units. This advantage usually translates into a reduction in the number of sampling units that need to be sampled to detect a given magnitude of change. The monitoring and evaluation protocols described below reflect the minimum monitoring necessary to ensure project goals and objectives are being met. These protocols, developed by Columbia Basin Fish and Wildlife Authority (CBFWA) members will be modified as new techniques are developed. Wildlife Area staff and Vegetation Management Team members will collect additional plant community and wildlife population data if needed.

Chapter VII. B1. Habitat Evaluation Procedures

A minimum of 25 percent of the baseline HEP transects, located in areas not directly effected by enhancements or maintenance activities, will be replicated by Wenas WA staff every five years to monitor general habitat trends. At least two baseline transects will be replicated in each cover type within each management unit. Evaluators will use the same measurement techniques/instruments described on Table 56 and within specific HEP models to measure habitat variables.

Evaluators will repeat the transect procedures described in Chapter V. B. Habitat Evaluation Procedure Methods and conduct HEP surveys within the same general time frame as the original baseline transects to ensure results are comparable. Photo points will also be re-photographed and/or established as needed. If time/funding constraints allow, more detailed plant community inventories will be conducted along with HEP variable information.

Chapter VII. B2. General Vegetation Monitoring - Shrubland/Grassland Cover Types

Vegetation sampling on shrub-steppe plant communities will focus on detecting changes in frequency of bluebunch wheatgrass, needle-and-thread grass, Idaho fescue, cheatgrass, and knapweed. Bluebunch wheatgrass, needle-and-thread, and Idaho fescue are native perennial bunchgrasses that are highly susceptible to grazing pressure and competition from non-native plant species. As a result, these species are good indicators of general habitat quality.[47]

Likewise, cheatgrass, mustards, Russian thistle, and knapweed are indicators of past/present disturbance. Frequency/percent cover of sagebrush spp. and bitterbrush will also be monitored to assess shrubland habitat quality/trends[48] (evaluators should review HEP transect results in Attachment 2 and/or confer with Vegetation Management Team members prior to modifying the species recommended for frequency monitoring) The rationale for using frequency is explained below.

[47] It is assumed that if bluebunch wheatgrass and needle and thread bunchgrasses are well represented within the plant community, general habitat quality and vegetation diversity is good.

[48] Grass and shrub species recommendations provided by Vegetation Management Team member Chuck Perry on May 2, 2000.

> Percent frequency was selected as the monitoring technique because it is appropriate for any plant species' growth form. It is appropriate for monitoring some annuals, whose density may vary year to year, but whose spatial arrangement of germination remains fairly stable such as cheatgrass. Rhizomatous species, especially graminoid species growing with similar vegetation, are often measured by frequency because there is no need to define a sampling unit such as percent cover or density. Frequency is also a good measure for monitoring invasions of undesirable species as well as increases/decreases in desirable species..
>
> Another advantage of frequency methods over methods for measuring cover is the longer time window for sampling. Once plants have germinated, frequency measurements are fairly stable throughout the growing season as compared to cover measurements which can change considerably from week to week as plants grow. The biggest advantage of frequency methods, however, is that the only decision required by the observer is whether or not a species occurs within the plot. Technicians can be easily taught to measure frequency with minimal training on methodology and species identification. If the species is easy to recognize, frequency plots can be evaluated quickly.

Frequency data only provides information on the number of individuals, or the change in that number relative to the size of the plot frame or its subsections. It is a good methodology to determine if a site has more or less plants of a specific species; however, it does not provide other information that may be useful for habitat or plant community characterization (Perry, pers. com.)

Frequency is also affected by both spatial distribution and the density of the population.[49] Because of this it is difficult to interpret changes biologically since it is not known if a change is due to density, distribution, or both. As a result, frequency data will be augmented with abundance and density information.

Frequency is a measure dependant upon plot size and shape. Plot size should be such that plants being measured fall between the 20 percent to 80 percent range (Perry, pers. com.). Therefore, the plots used to determine frequency must be identical to compare different studies. Herbaceous cover and frequency data, collected during the HEP baseline analysis, was obtained using the same 0 .5 meter^2 rectangular microplot as recommended for use in this M&E protocol. Frequency data from baseline transects can be used, rather than a pilot study, to estimate M&E transect sample size.

Transect Procedures

A minimum of two transects will be established for each cover type within each management unit. Transect locations/start points will be determined using standard procedures (this can be

[49] Greig-Smith, P. 1983. Quantitative plant ecology. 3rd edition, Berkeley: University of California Press.

accomplished as a pre-field activity). Transects will be established at least 100 meters from the edge of the cover type and away from roads and other anthropogenic factors (unless the disturbed area is the target site) as follows:

1. Select a random azimuth (direction) from a random numbers table or other suitable device/technique. Stretch and secure a 100 meter tape along the random azimuth to establish the 100 meter baseline transect (document compass azimuth and declination on transect data sheets).

2. Document the location of baseline transects with Global Positioning System (GPS) equipment and plot on field maps (record GPS coordinates and other pertinent location information on transect forms).

3. Establish ten perpendicular transects (90 degrees off baseline), 30 meters in length, along the baseline transect (record azimuth on data forms). The location of the first perpendicular transect is selected at random and placed between 0-10 meters from the start point (0 meter mark). Place the following transects systematically at ten meter intervals. For example, if the first perpendicular transect is positioned at the 5 meter mark, the second transect is placed at the 15 meter mark, the third at the 25 meter mark and so on until 10 perpendicular transects are established. Permanently mark the start and end points of the baseline and perpendicular transects.

4. Position ten microplots (0.5 meter^2 rectangular microplot) systematically along each perpendicular transect from a random start point. The placement of microplots is determined by selecting a random number between 0 and 3 (the first data collection point for the transect). Starting at the first data collection point, place the microplot at 3 meter intervals along the perpendicular transect until 10 microplot measurements are taken. For example, if the first data point is 2 meters, the second data point is at 5 meters, the third at 8 meters and so forth (10 perpendicular transects x 10 microplots = 100 per survey).

5. Photo-document transects. Take three photographs per transect from transect start point. Position the camera one meter above the ground (use one meter cover board or similar device for camera rest); set 1.5 meter cover board on 10 meter mark of baseline transect along with transect photo board and photograph. Repeat procedure half way between the baseline and first perpendicular transect (45 degrees off baseline). Take the third picture along the first perpendicular transect using the same procedure. Record camera type, aperture, distance and azimuth to cover board, cover board dimensions, date, time of day, transect/location identification, GPS coordinates, and photographer (cover boards will be supplied by WDFW mitigation staff).

Facing towards the end point of the perpendicular transect, data recorders walk on the left side of the transect line, to avoid trampling vegetation, and take measurements on the right side of the transect line. The long axis of the microplot is placed perpendicular to the transect azimuth with the lower right hand corner of the microplot at the data collection point. This procedure is repeated for each

perpendicular transect. If possible, microplot data points should be permanently marked. Transect layout is illustrated in Figure 19 while microplot placement and shrub intercept "point" count intervals are shown in Figure 20.

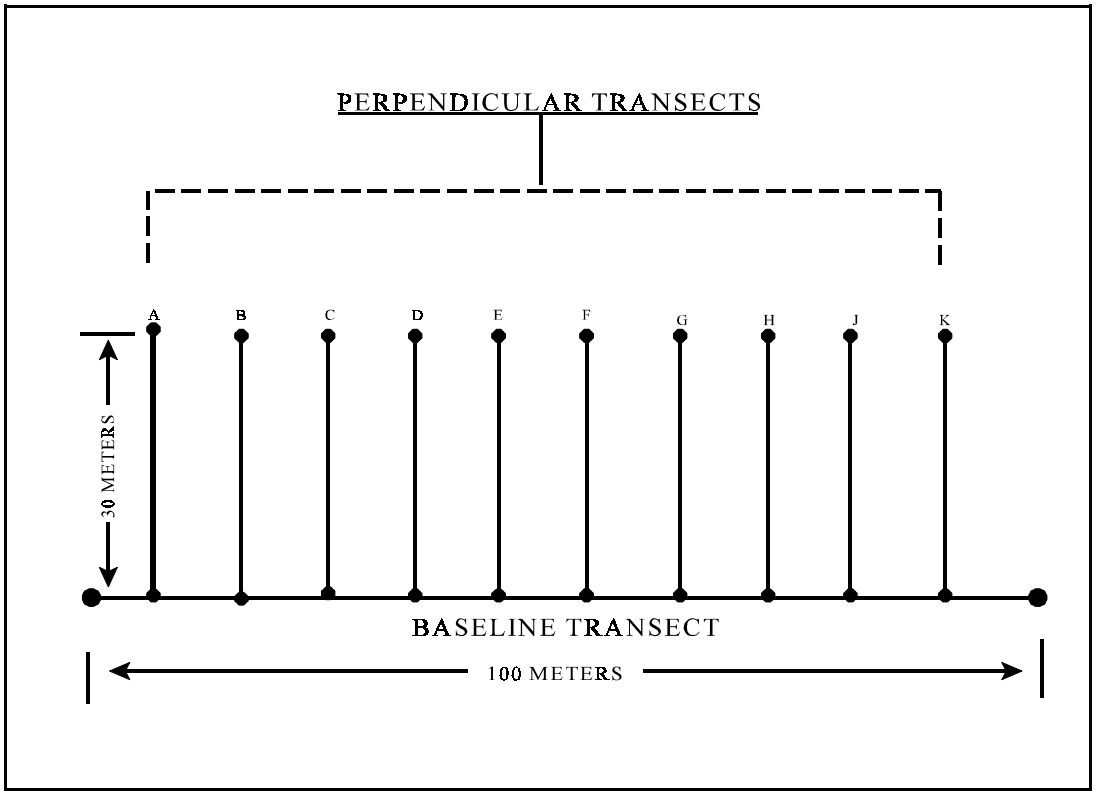


Figure 19. Monitoring and evaluation transect layout.

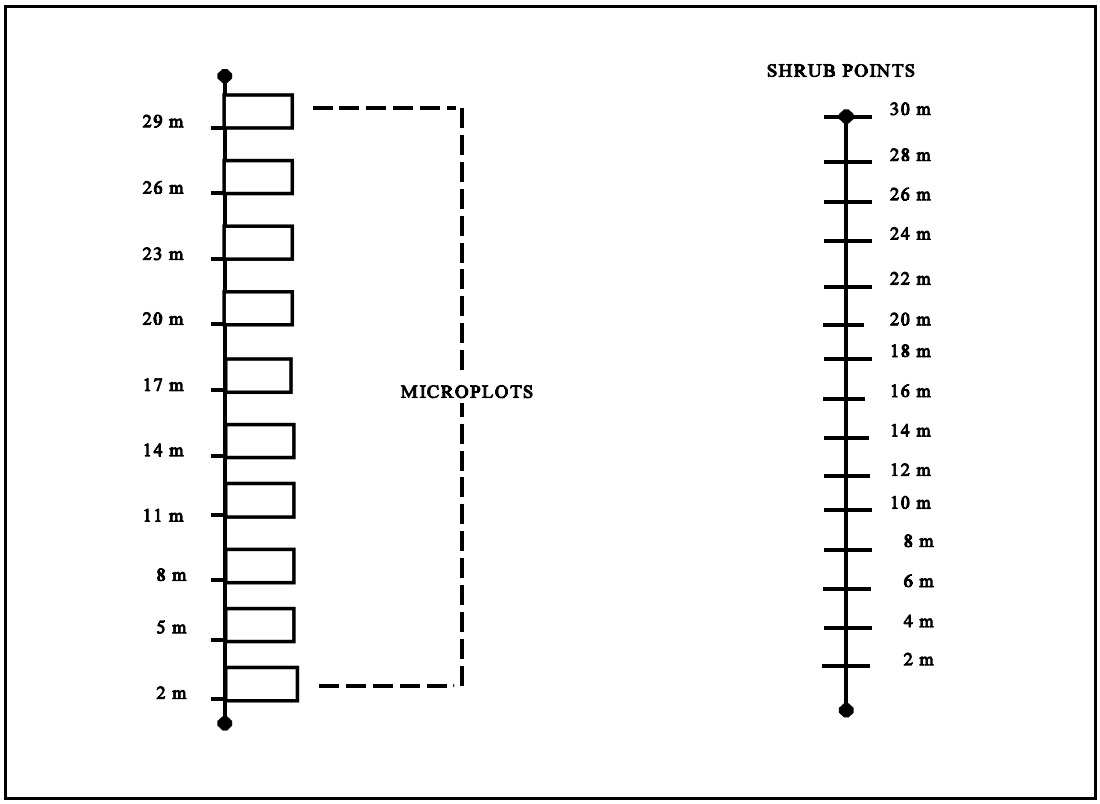


Figure 20. Microplot and shrub "point" placement on perpendicular transects (not to scale).

Herbaceous vegetation frequency, abundance, and density measures are collected using a 0 .5m ^{2} rectangular microplot as the sampling unit. The microplot is divided into 20 percent increments to facilitate collection of abundance and percent cover data (Figure 21). Frequency is determined by simply noting whether or not a given species is rooted within the microplot. For example, if 100 microplots are laid out and species "A" occurs in 25 of the plots, frequency is 25 percent.

Abundance, ranging from one to five, is the number of 20 percent increments within a microplot a species is rooted in. Figure 22 illustrates an example of an abundance factor of three (count the number of 20 percent increments a species is rooted in, not the number of individual plants).

Density, in contrast, is the number of individuals of a given species rooted within the entire microplot. Density is divided into 5 classes: Class 1 - 1 to 5 individuals, Class 2 - 6 to 10 individuals, Class 3 - 11 to 15 individuals, Class 4 - 16 to 20 individuals, Class 5 - above 20 individual plants. Classes may be adjusted based on target species growth form i.e., if the plant species of interest is very small, 20 individuals may not be significant (always document changes to protocols). Density measurements are most sensitive to changes caused by mortality or recruitment. Figure 23 depicts a microplot with a density factor of three.

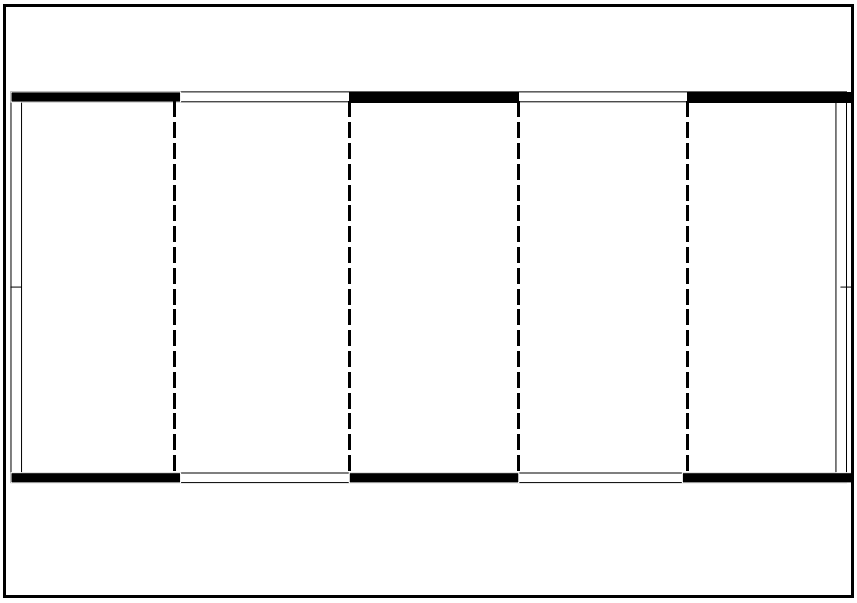


Figure 21. A microplot divided into 20 percent increments.

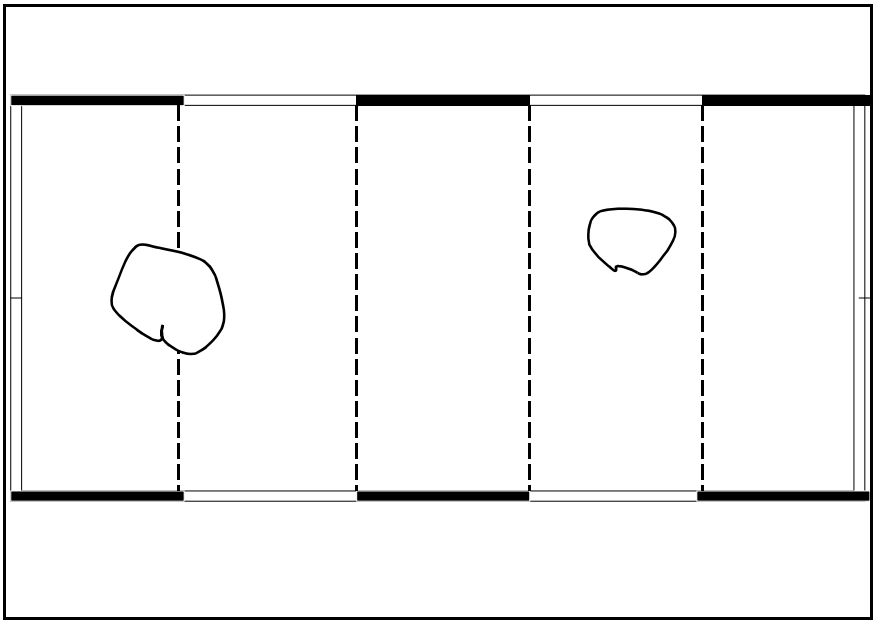


Figure 22. A microplot with an abundance factor of three (plants are rooted in three segments).

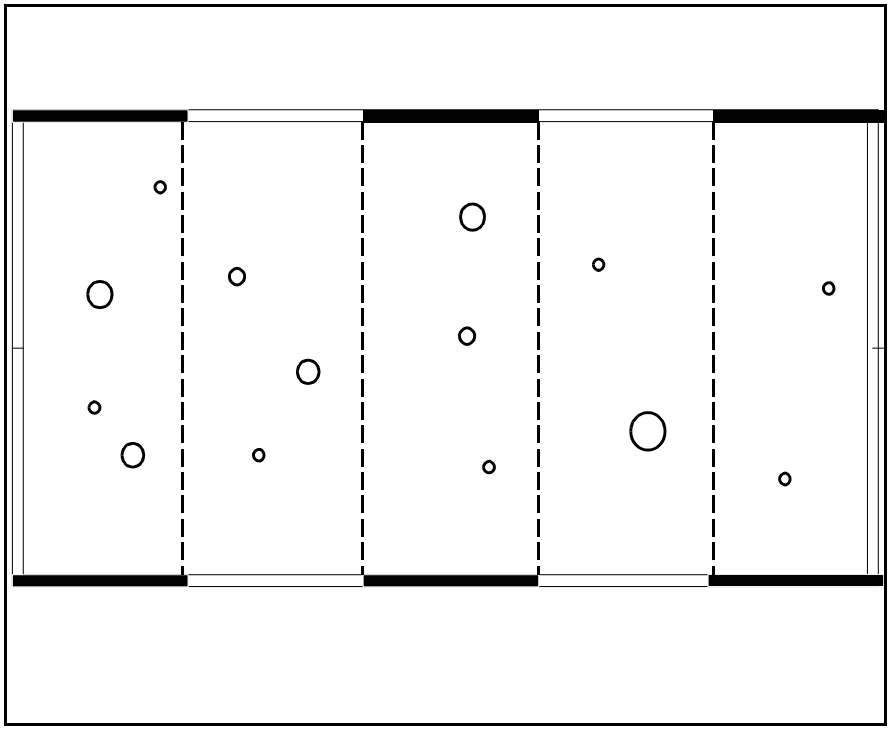


Figure 23. A microplot with a density class of three (11 to 15 plants per microplot).

Whether measuring frequency, abundance, or density, plants that are partially rooted both in and outside of the microplot are counted in and out alternately along the boundary i.e., count every other plant. Plant community inventories will be conducted on at least one transect per cover type in conjunction with the M&E microplot surveys if time and funding is available. In addition to frequency, abundance, and density information, plant inventory data includes species composition, height, and percent cover for each microplot.

Shrub data collected on each perpendicular transect includes: species, frequency, percent cover, height, and age. Shrub frequency and cover are determined using "point" counts at two meter intervals (systematically) starting at the 2 meter mark on each transect (15 points per transect, or 150 total). The line intercept method is an alternative technique for collecting percent cover for shrubs (this technique will add to the time required to complete each transect, but is hard to beat).

Shrub height is measured at the highest vertical projection a shrub extends directly above the data point. Shrub age classes are broken down into 5 categories: Young-non flowering/seed bearing (includes seedlings), Mature-generally flowering and/or seed bearing, less than 25% of the plant is dead, Decadent- 25-50% is dead material, Very Decadent- more than 50% is dead, Dead-no living material remains on the shrub.

Chapter VII. B3. General Vegetation Monitoring - Forest and Riparian Cover Types

Forest and riparian cover type transects are established as described in Chapter V. B. Habitat Evaluation Procedure Methods. Due to the linear juxtaposition of most forest and riparian areas, 1000 foot (300 meter) line intercept transects will be established for monitoring purposes. Baseline HEP transects may be replicated instead of establishing new transects. M&E will occur at five year intervals, or earlier if required. At least one M&E transect will be established in riparian cover types and a minimum of two M&E transects will occur on xeric forested sites in each management unit.

In forest and riparian cover types the following habitat attributes will be documented/measured:
1. Tree stratum: species, percent canopy cover, mean height, number snags ≥4 inches DBH., mean DBH, basal area, and stems per acre/hectare (on treated sites).
2. Shrub stratum: species, percent cover, and mean height
3. Herbaceous stratum: dominant grass, forb, and weed species, frequency, abundance, density, and/or percent cover.

Transect procedures

1. Establish random 1,000 foot (300 meter) baseline transects within cover type (ten 100 foot/30 meter sampling units).
   A. Measure tree canopy cover at 10 foot (3 meter) increments along transect (identify species).
   B. Measure tree height of over-story canopy at 100 foot (30 meter) intervals.
   C. Take herbaceous vegetation measurements at 25 foot (7.5 meter) intervals with microplot.
   D. Measure/estimate shrub intercept, height, and age class by species.
2. Establish ten one tenth acre (0.04 hectare) circular plots[50] at 100 foot (30 meter) intervals (Figure 24).
   A. Count the number of snags ≥4 inches DBH.
   B. Measure DBH (identify species)
   C. Measure basal area
   D. Count the number of tree stems per plot on treated sites

Photo-document transects from transect start point. Photograph along baseline transect as described for shrubland and grassland transects. If vegetation is too dense, photograph from a point perpendicular to the transect. Mark location with a permanent monument and describe.

[50] Approximately a 37 foot radius.

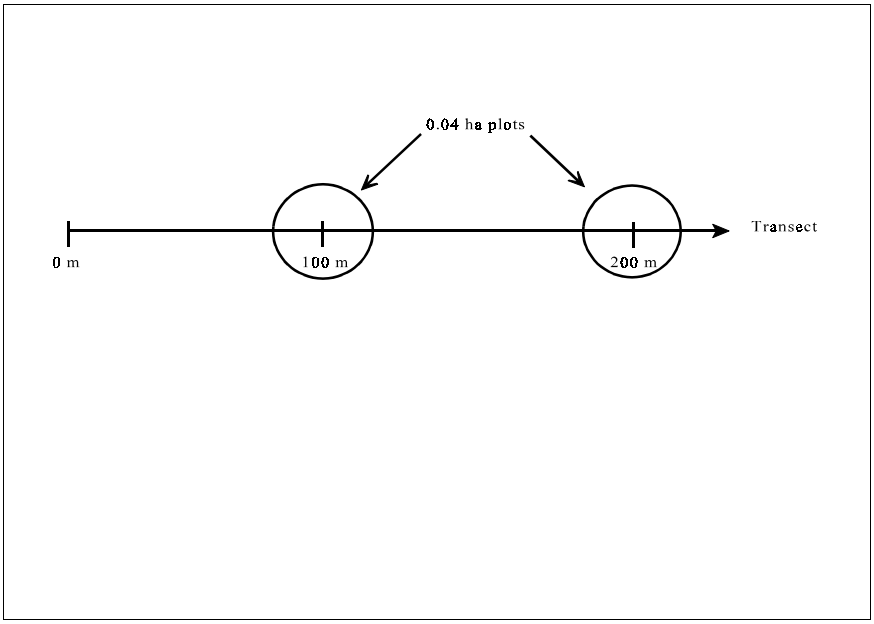


Figure 24. Forest and riparian cover type transect layout.

Chapter VII. B4. Site Specific Enhancement and Maintenance Activity Monitoring

Enhancement and operation and maintenance activities will be monitored to ensure that management strategies are accomplishing project objectives. If necessary, adaptive management strategies will be implemented to modify existing enhancement/O&M activities to meet specific objectives.

Evaluators will follow procedures described in previous sections to establish monitoring transects in shrubland, grassland, forest, and riparian cover types. Two monitoring transects will be established at each grassland/shrubland enhancement site more than 200 acres in size (if less than 200 acres, only one monitoring site will be established). A minimum of one monitoring transect will be established in enhanced forest and riparian areas. Roadside weed control projects will be monitored using linear transects with microplots set at three meter intervals (a minimum of two transects per management unit).

Enhanced grassland/shrubland cover type vegetation will be monitored at five year intervals. Roadside weed control projects will be monitored at two year intervals. Weed control monitoring will involve monitoring both desirable and undesirable species. For example, if an area has diffuse knapweed and the objective is to reduce this and develop a higher quality native plant community, evaluators would monitor both the decline of the knapweed and the increase of a desirable species such as bluebunch wheatgrass (Perry, pers. com.).

Pre-enhancement/maintenance photo-documentation and vegetation surveys will occur where possible. Enhancement/maintenance activity results will be photographed one year after enhancement/maintenance activities are implemented and every two years thereafter (after five years, photographs will be taken at five year intervals for the life of the project).

Chapter VII. B5. Vegetation Monitoring/Sampling Objectives

As previously stated, monitoring objectives are linked to management objectives. M&E focuses on detecting change and determining habitat trends. The following examples illustrate how management objectives, monitoring/sampling objectives, and management response are inter-related to form a comprehensive management plan. Wildlife managers may modify these examples to fit specific needs and will develop similar objectives as part of general M&E protocols.

Example 1:

Management Objective:	Decrease percent frequency of diffuse knapweed by 50 percent along roads in the Umtanum Creek Unit by the end of FY 2005.
Sampling Objective:	Be 90% certain of detecting a 20% change in frequency of diffuse knapweed with a false change rate of 0.10.
Management Response:	If diffuse knapweed frequency fails to decrease, additional research of potential management options will be initiated and adaptive management strategies will be implemented by end of FY 2006.

Example 2:

Management Objective:	Maintain mean frequency of bluebunch wheatgrass within the shrubland cover type on the Umtanum Creek Unit within 20% of the 1999 mean frequency (85%) between FY 2000 and FY 2005.
Sampling Objective:	Be 95% certain of detecting a 20% change in frequency of bluebunch wheatgrass with a false change rate of 0.10.
Management Response:	Failure to maintain the minimum frequency will trigger a study examining interactions between “rest” and “disturbance” management regimens, climatic factors, and elk/herbivore grazing in the area; with alternative management measures implemented within four years after the first year the unacceptable level of decline is measured.

Example 3:

Management Objective: Increase mean stem density and percent cover of quaking aspen/cottonwood trees by 30% within the riparian forest cover type on the North Clemans Mountain Unit by end of FY 2008.

Sampling Objective: Be 90% certain of detecting a 20% change in stem density and percent cover of aspen and cottonwood trees with a false change rate of 0.10.

Management Response: Failure to meet the objective will result in more intensive monitoring to determine the cause of the failure, and implementation of adaptive management by end of FY 2010

Example 4:

Management Objective: Restore 80 acres of abandoned cropland to native like shrub-steppe habitat on the Roza Creek Unit by the end of FY 2003.

Sampling Objective: Establish pre and post photo plots and photo-document at target years 0, 1, 3, 5, 10. Conduct pre and post planting surveys at target years 0, 1, 5, 10. Conduct weed surveys annually.

Management Response: Reseed and control weeds as necessary on an annual basis.

Chapter VII. B6. Vegetation Monitoring Statistics

Background

The following paragraphs are intended to provide only a cursory review of the statistical concepts needed to analyze M&E data. The book references and computer software/shareware programs, listed at the end of this chapter, provide more detailed statistical theory and/or can be used to determine sample size and interpret data.

If management objectives require detecting change from one period to another in some average value such as a mean or proportion, then statistical analysis consists of a significance test, also called a hypothesis test. This situation occurs in monitoring and involves analysis of two or more samples from the same monitoring site at different times (generally two or more years of data).[51]

The primary question asked is whether or not there has been a true change in the parameter of interest over a particular period of time. In other words, significance tests are used to assess the probability of an observed difference being real or the result of the random variation that comes from taking

[51] Measuring and Monitoring Plant Populations, BLM Technical Reference 1730-1. BLM, Denver, CO. 477 pps.

different samples to estimate the parameter of interest. The parameters of interest are usually means and proportions.

A hypothesis is a prerequisite to the use of a significance test. In monitoring, this hypothesis is usually that no change has occurred in the parameter of interest. The "no change" hypothesis is known as the "null" hypothesis (H_O). If after applying a significance test the conclusion is that the observed change in a parameter between two or more years is not likely do to stochastic variation, then the null hypothesis is rejected in favor of an alternative hypothesis (H_A) i.e., that there has been a change in the parameter of interest. If change is detected, it also important to note the direction of change.

To test the null hypothesis the difference between the two sample means must be quantified with a "test statistic."[52] When the test statistic is sufficiently large, the null hypothesis of no difference between population means is rejected. Evaluators specify, in advance, how large the test statistic must be in order to reject or accept the null hypothesis by specifying a critical or threshold significance level (*P* value).

The *P* value is the probability of obtaining a value of the test statistic as large or larger than the *P* value computed for the data when in reality there is no difference between the two populations. For example, if through the analysis a *P* value of 0.18 is derived and the chosen test statistic threshold value is 0.20, then we conclude that the true population mean has changed. There is an 18% chance that the conclusion is wrong (that no true change has occurred and that a false change error has been committed). In contrast, if the *P* value from the analysis was 0.85, we would conclude the true population mean has not changed, because the calculated value is larger than the threshold *P* value of 0.20 (there is a possibility that a missed change error has occurred). Actual data analysis *P* values should be reported (instead of reporting: $P < 0.20$, report $P = 0.18$).

It is recommended that evaluators use a *P* value of 0.10 or 0.05 for threshold values in this M&E program (evaluators will consult with Vegetation Management Team members before changing the recommendations). Furthermore, evaluators will document the rationale for selecting *P* values other than 0.10 or 0.05.

Statistical Tests

Table 63 lists significance tests used to analyze data for the differences between the means and proportions of two or more samples. Means include measures such as percent cover, density, and height while proportions refer primarily to frequency measurements. The tests listed in Table 63 are not all inclusive. If used as recommended, however, data analysis will be standardized and consistent between mitigation projects.

[52] Glantz, S. A. 1992. Primer of biostatistics, 3rd edition. New York, NY: McGraw-Hill.

Table 63. Significance tests/recommendations for monitoring and evaluation data analysis.

Significance Test	Analyzes:		Used to Analyze:	Recommended for use:
	Means	Proportions		
One-tailed *t* test	Yes	No	Independent samples	Limited
Two sample *t* test	Yes	No	Independent samples	Yes
Paired *t* test	Yes	No	Paired samples	Yes
Analysis of variance[53]	Yes	No	Independent samples	Limited
Chi-square test	No	Yes	Independent samples	Yes
McNemar's test	No	Yes	Paired samples	Yes

Statistical software packages to determine sample size and conduct significance tests are commercially available (Pass 2000, NCSS, Statistix etc.), or through shareware programs such as "STPLAN" at **http://odin.mdacc.tmc.edu/** (click on "Free computer code from the Section of Computer Science," click on "Software" then go to "STPLAN" and follow instructions). Sample size programs are also available from mitigation staff (Paul Ashley) at WDFW's Spokane Regional Office. In addition, both Microsoft and Corel spreadsheets include significance test programs.

Two excellent hard copy publications that are readily available are BLM Technical Reference 1730-1, Measuring and Monitoring Plant Populations (copies available from: BLM National Business Center, BC-650B, P.O. Box 25047, Denver, Colorado 80225-0047), and Biostatistical Analysis, 4th edition by J.H. Zar (published by Prentice Hall available through most book stores).

Chapter VII. B7. Wildlife Monitoring

Background

Monitoring will occur annually or on a rotating basis depending on the status of the species. The primary species of concern for monitoring purposes include neotropical birds, Rocky Mountain elk, mule deer, California big horn sheep, jackrabbit *(Lepus spp.),* sage grouse, golden eagle *(Aquila chrysaetos),* prairie falcon *(Falco mexicanus),* burrowing owl *(Athene cunicularia),* goshawk *(Accipiter gentilis),* and mourning dove *(Zenaida macroura).*

[53] Analysis of variance (ANOVA) is used when three or more years of data is analyzed.

Monitoring will be accomplished primarily by WDFW Region III District Wildlife Biologists with assistance from Wenas Wildlife Area staff. Multiple funding sources will be used to complete wildlife surveys i.e., WDFW funds, personalized license plate moneys (PLP), Pittman/Robertson (PR) funds, and BPA allocations (WWA staff time). Current and proposed monitoring efforts, described below, will follow protocol outlined by WDFW District Biologists (Leray Stream pers. com.).

General monitoring protocols

Rocky Mountain elk, an important recreational and public viewing species, are monitored annually by helicopter during late winter (direct counts) using quadrat surveys chosen randomly on a herd wide basis. Herd composition/trends and population estimates are computed from data collected on the surveys. District Wildlife Biologists will lead the effort while WWA staff will lend cursory support. WDFW and PR funds are currently used to support these surveys.

Mule deer are monitored annually by helicopter (direct counts) using quadrat surveys chosen randomly on a herd wide basis. Current methodologies are being redesigned to improve data quality in order to make better population inferences. District Wildlife Biologists will lead the effort while WWA staff will assist with the surveys. Mule deer are an important native recreational wildlife species. WDFW and PR funds are currently used to support these surveys.

California big horn sheep, once extirpated from the wildlife area, are an important recreational and viewing native wildlife species. The present population is used as a source for establishing sheep on other suitable sites throughout the state. Big horn sheep are very susceptible to disease. As a result, this species is monitored closely by WDFW. Annual helicopter surveys are conducted in June (ground surveys have been employed in the past). Periodic winter surveys are also conducted. District Wildlife Biologists will lead the effort while WWA staff will lend cursory support. Like elk and mule deer, WDFW and PR funds are currently used to support these surveys.

Jackrabbits will be monitored periodically by WWA staff and WDFW District Biologists funded with PLP dollars. Monitoring will be comprised primarily of road surveys. Native jackrabbit populations have recently plummeted throughout Washington State. As a result, their status is currently under review.

Sage grouse are dependent upon large expanses of un-fragmented shrub-steppe habitat and are likely only an occasional visitor to the Wenas Wildlife Area. Their present population status on the WWA is unknown at this juncture. Due to the low numbers observed in the recent past, only observational data will be recorded initially, followed by lek searches in the future. WWA staff will have the primary responsibility for obtaining observational data and searching for lek sites in the future.

Golden eagles territories are monitored on a rotating basis with other species utilizing both helicopter and ground survey techniques. All nest sites are monitored and protected from disturbance. Population trends and site protection data is summarized as part of a regional planning/monitoring

effort. District Wildlife Biologists, funded with PLP dollars, will lead the effort while WWA staff will assist with the surveys.

Prairie falcons, a native species, are monitored periodically by District Wildlife Biologists funded with PLP dollars. Future monitoring will include assistance from WWA staff. Information from the surveys is added to the statewide monitoring data base.

Burrowing owls have been monitored periodically over the preceding 20 years (burrow and direct counts). Present populations are low throughout the state. The Wenas Wildlife Area has the only known colony occurring in the Yakima County area. The species is currently under a three year monitoring/evaluation plan funded with PLP dollars and supported by District Wildlife Biologists. Future protection efforts and monitoring will be, in part, the role of the WWA manager.

Goshawk, an indicator species for late seral stage forest habitat, nest sites are monitored by District Wildlife and Habitat biologists. PLP and WDFW funds support monitoring efforts. WWA managers will play a key role in protection of nest sites in the future.

Neotropical bird point count surveys were established several years ago in native shrub communities as part of a larger statewide effort (funded with PLP dollars). WWA staff will be responsible for conducting these surveys. Neotropical bird species richness is a good indicator of native shrub community quality.

Mourning doves, an important recreational species, are monitored annually by District Wildlife Biologists funded with PR dollars. One survey route has been established on a portion of the Wenas Wildlife Area. This route will be monitored by the WWA manager in the future.

Additional wildlife surveys will be developed to monitor priority species and habitats as needed. Monitoring wildlife populations, species response, and habitat on the Wenas Wildlife Area is a collaborative, multi-funded effort. If M&E activities indicate that habitat objectives are not being satisfied, wildlife area managers will apply adaptive management principles to modify this plan accordingly. All M&E information will be documented and submitted to BPA in annual reports.

This completes the Wenas Wildlife Area Work Plan. General access strategies are included in Appendix C. Attachments are organized as a separate document, due to their volume, while Appendices are included below.

Appendix A. Wenas Wildlife Area vegetation list

Designator	Genus/Species	Common Name
ACGLD2	Acer glabrum ssp. douglasii (Hook.) Wesmael	douglas maple
ACHE10	Achnatherum hendersonii (Vasey) Barkworth	henderson ricegrass
ACMI2	Achillea millefolium L.	common yarrow
ACRU2	Actaea rubra (Ait.) Willd.	red baneberry
ALRH2	Alnus rhombifolia Nutt.	white alder
ALVIS	Alnus viridis ssp. sinuata (Regel) A.& D. Love	Sitka alder
AMAL2	Amelanchier alnifolia (Nutt.) Nutt. ex M. Roemer	Saskatoon serviceberry
ARAR8	Artemisia arbuscula Nutt.	low sagebrush
ARCO9	Arnica cordifolia Hook.	heartleaf arnica
ARRI2	Artemisia rigida (Nutt.) Gray	stiff sagebrush
ARTRT	Artemisia tridentata ssp. tridentata Nutt.	basin big sagebrush
ARTRT2	Artemisi tripartita ssp. tripartita Rydb.	Idaho threetip sagebrush
ARTRV	Artemisia tridentata ssp. vaseyana (Rydb.) Beetle	mountain big sagebrush
ARUV	Arctostaphylos uva-ursi (L.) Spreng.	kinnikinnick
BASA3	Balsamorhiza sagittata (Pursh) Nutt.	arrowleaf balsamroot
BROMU	Bromus spp	brome
BRTE	Bromus tectorum L.	cheatgrass
CAGE2	Carex geyeri Boott	elk sedge
CALAM	Calamagrostis spp	reedgrass
CAREX	Carex spp	sedge
CARU	Calamagrostis rubescens Buckl.	pinegrass
CEVE	Ceanothus velutinus Dougl. ex Hook.	snowbrush ceanothus
CHVI8	Chrysothamnus viscidiflorus (Hook.) Nutt.	green rabbitbrush
CLLI2	Clematis ligusticifolia Nutt.	western white clematis
COSE16	Cornus sericea L.	redosier dogwood
DELP	Delphinium spp	larkspur
ELELH	Elymus elymoides ssp. hordeoides (Suksdorf)	bottlebrush squirreltail
ERIGE	Erigeron spp	fleabane
ERIOG	Eriogonum spp	buckwheat
ERNAN3	Ericameria nauseosa ssp. nauseosa	gray rabbitbrush
FEID	Festuca idahoensis Elmer	Idaho fescue
HODI	Holodiscus discolor (Pursh) Maxim.	oceanspray
LATHY	Lathyrus spp	peavine
LONIC	Lonicera spp	honeysuckle
LUPIN	Lupinus spp	lupine
MAAQ2	Mahonia aquifolium (Pursh) Nutt.	hollyleaved barberry / oregongrape
MAST4	Maianthemum stellatum (L.) Link	starry false Solomon's seal
PAMY	Pachistima myrsinites	Mountain boxwood
PHLE4	Philadelphus lewisii Pursh	Lewis' mockorange
PHLOX	Phlox spp	phlox
POA	Poa spp	bluegrass
POBU	Poa bulbosa L.	bulbous bluegrass
POSE	Poa secunda J. Presl	Sandberg bluegrass
POTR5	Populus tremuloides Michx.	quaking aspen
PREM	Prunus emarginata (Dougl. ex Hook.) Walp.	bitter cherry

PRVI	Prunus virginiana L.	common chokecherry
PSSP6	Pseudoroegneria spicata (Pursh) A. Love	bluebunch wheatgrass
PUTR2	Purshia tridentata (Pursh) DC.	antelope bitterbrush
RIAU	Ribes aureum Pursh	golden currant
RIBES	Ribes spp	currant
RICE	Ribes cereum Dougl.	wax currant / squaw currant
ROSA5	Rosa spp	rose
RUPA	Rubus parviflorus Nutt.	thimbleberry
SACEC	Sambucus cerulea var. cerulea Raf.	blue elderberry
SPBE2	Spiraea betulifolia Pallas	White spirea/ Birch leaved spirea
SPDO	Spiraea douglasii Hook.	Douglas' spirea
SPIRA	Spiraea spp	spirea
STIPA	Stipa spp	needlegrass
SYAL	Symphoricarpos albus (L.) Blake	common snowberry
VACCI	Vaccinium spp	vaccinium / huckleberry
VICIA	Vicia spp	vetch
VIOLA	Viola spp	violet

Appendix B. HEP transect table

Transect #	Air Photo #	Habitat Type	Transect Length	Management Unit	Date of Transect
001	17-3	Grassland (Planted)	2000'	So. Umtanum Ridge	July 30, 1997
002	18-7	Shrubland	2000'	Roza Creek	July 30, 1997
003	19-11	Riparian Forest Dense Shrub	2000'	Roza Creek	August 5, 1997
004	18-7	Dense Shrub	2000'	Roza Creek	August 6, 1997
005	18-7	Grassland (Lithosol)	400'	Roza Creek	August 6, 1997
006	20-5	Grassland	2000'	So. Umtanum Ridge	August 19, 1997
007	17-5	Riparian Dense Shrub	1800'	So. Umtanum Ridge	August 5, 1997
008	16-16	Riparian Forest Dense Shrub	1600'	Umtanum Creek	October 16, 1997
009	16-12	Grassland (Lithosol)	2000'	So. Umtanum Ridge	October 22, 1997
101	5-8	Forest Shrubland	2000'	No. Cleman Mountain	July 15, 1998
102	5-8	Riparian Forest Dense Shrub	1000'	No. Cleman Mountain	July 21, 1998
103	5-8	Forest Grassland	2000'	No. Cleman Mountain	July 28, 1998
104	8-8	Shrubland	1000'	No. Cleman Mountain	July 28, 1998
105	5-7	Forest Grassland	1000'	No. Cleman Mountain	September 1, 1998
106	5-7	Grassland (Lithosol)	2000'	No. Cleman Mountain	September 2, 1998
107	13-15	Dense Shrub	3000'	Umtanum Creek	September 3, 1998
108	13-15	Grassland (Lithosol)	1000'	Umtanum Creek	September 10, 1998
109	13-15	Shrubland	1100'	Umtanum Creek	September 10, 1998
110	4-9	Riparian Forest Shrubland	1000'	No. Cleman Mountain	September 14, 1998
111	4-10	Riparian Forest Dense Shrub	1000'	No. Cleman Mountain	September 15, 1998
112	4-10	Forest Grassland	2000'	No. Cleman Mountain	September 15, 1998
113	3-3	Forest Shrub/Grass	2000'	No. Cleman Mountain	September 15, 1998
114	7-9	Forest Dense Shrub	2000'	No. Cleman Mountain	September 21, 1998
115	7-9	Riparian Forest Dense Shrub	600'	No. Cleman Mountain	September 21, 1998
116	7-4	Grassland (Lithosol)	1000'	No. Cleman Mountain	September 22, 1998
117	8-8	Dense Shrub	1000'	No. Cleman Mountain	September 22, 1998
118	7-9	Shrubland	1000'	No. Cleman Mountain	September 22, 1998
119	9-6	Grassland (Shrub/Grass)	1000'	No. Cleman Mountain	September 23, 1998

120	3-14	Forest Dense Shrub	1000'	No. Cleman Mountain	September 28, 1998
121	3-13	Forest Shrub/ Grass	2000'	No. Cleman Mountain	September 28, 1998
023	18-17	Shrubland (Mellergaard)	1000'	Umtanum Creek	April 19, 1999
024	18-17	Dense Shrub (Mellergaard)	1000'	Umtanum Creek	April 19, 1999
025	18-17	Grassland CRP (Mellergaard)	1000'	Umtanum Creek	April 20, 1999
026	18-17	Shrubland (Mellergaard)	1000'	Umtanum Creek	April 20, 1999
027	12-17	Grassland (Lithosol)	1000'	Umtanum Creek	April 20, 1999
028	13-17	Grassland (Shrub/Grass)	1000'	Umtanum Creek	April 21, 1999
0281	13-17	Dense Shrub	1000'	Umtanum Creek	April 26, 1999
029	13-17	Dense Shrub	1000'	Umtanum Creek	April 26, 1999
030	13-17	Dense Shrub	1000'	Umtanum Creek	April 27, 1999
031	13-17	Grassland (Shrub/Grass)	1000'	Umtanum Creek	April 27, 1999
032	17-17	Grassland (Lithosol) (Mellergaard)	1000'	Umtanum Creek	April 27, 1999
033	13-15	Grassland (Lithosol)	1000'	Umtanum Creek	April 28, 1999
034	13-17	Grassland	1000'	Umtanum Creek	April 28, 1999
035	16-14	Shrubland	1000'	Umtanum Creek	May 3, 1999
036	16-14	Shrubland	1000'	Umtanum Creek	May 3, 1999
037	16-14	Grassland (Shrub/Grass)	1000'	Umtanum Creek	May 4, 1999
038	16-14	Dense Shrub	1000'	Umtanum Creek	May 4, 1999
039	16-14	Dense Shrub	400'	Umtanum Creek	May 4, 1999
040	8-11	Grassland	1000'	So. Umtanum Ridge	May 10, 1999
041	9-9	Dense Shrub	1000'	So. Umtanum Ridge	May 11, 1999
042	9-9	Dense Shrub	1000'	So. Umtanum Ridge	May 11, 199
043	9-9	Dense Shrub	1000'	So. Umtanum Ridge	May 11, 1999
044	9-9	Dense Shrub	1000'	So. Umtanum Ridge	May 11, 1999
045	9-9	Grassland (Planted)	1000'	So. Umtanum Ridge	May 12, 1999
046	10-9	Grassland	1000'	So. Umtanum Ridge	May 12, 1999
047	9-12	Grassland	1000'	So. Umtanum Ridge	May 17, 1999
048	9-12	Grassland	1000'	So. Umtanum Ridge	May 17, 1999
049	9-12	Grassland (Shrub/Grass)	1000'	So. Umtanum Ridge	May 18, 1999
050	9-12	Grassland	1000'	So. Umtanum Ridge	May 18, 1999

051	9-12	Grassland (Shrub/Grass) 1000'	So. Umtanum Ridge	May 18, 1999
052	9-12	Grassland 1000'	So. Umtanum Ridge	May 18, 1999
053	17-12	Grassland 1000'	Umtanum Creek	July 13, 1999
054	17-12	Grassland 800'	Umtanum Creek	July 13, 1999
055	17-12	Grassland (Lithosol) 1000'	Roza Creek	July 13, 1999
056	17-12	Grassland 600'	Roza Creek	July 14, 1999
057	17-12	Grassland 600'	Roza Creek	July 14, 1999
058	18-12	Shrubland 1000'	Umtanum Creek	July 14, 1999
End				
		67 Total Transects		
		80,900' Surveyed		
		15.32 Miles		

There was no transect numbered 010, this was the transition from 1997 to 1998 surveys.
There was no transect numbered 122 or 022, this was the transition from 1998 to 1999 surveys.

Appendix C. Wenas Wildlife Area/WDFW General Access Management Strategies.

The Wenas Wildlife Area was purchased with Federal recreation dollars. Therefore, WDFW is obligated to provide public access. WDFW will direct public use to areas where the potential for resource damage is minimal. This will be accomplished through road management, road/trail maintenance, weed control activities, and habitat enhancements including re-seeding areas with native-like species. In addition, increased signing will be used to educate the public and expand awareness of the impacts of public use on State lands. The following paragraphs describe, in general terms, WDFW's access management program on the Wenas Wildlife Area while acknowledging the predominant potential weed vector sources.

Road Access

A cooperative road access management plan is currently in place on the Wenas Wildlife Area. Referred to as the "Green Dot Road System", this cooperative agreement involves all major landowners within the designated area (WDFW, WDNR, Boise Cascade Corp. within the Wenas Plan Area). Within the road management area, only specifically identified roads are open to motorized use by the public. Each road management area went through public review when initially put into place in the early 1990's. Given the road maintenance requirements under the new Forest and Fish regulations, it is expected that each road management area will go through an update, again with public involvement.

Timber Harvest

The North Cleman Mountain Unit contains the majority of the forested ground where timber harvest would be expected to occur. Boise Cascade Corporation owns the perpetual timber rights on these forested areas within WDFW ownership. These lands, as well as the lands leased from WDNR that are forested, can be expected to receive some level of harvest. Log haul will occur across WDFW lands. In most cases, WDFW issues a temporary use permit with requirements deemed necessary for protecting the resources of the state. Standard clauses include requirements to control weeds where WDFW lands are crossed, closure of new roads or re-closure of roads that were re-opened for log haul, and grass seeding of these roads.

Cattle Grazing

There is currently no cattle grazing on the Wenas Wildlife area, and there is little opportunity for trespass cattle to cause damage or spread weeds. The elk fence provides an exterior boundary for the portions of the Wildlife Area that are adjacent to private agricultural land. The US Forest Service is the primary landowner to the west, the Yakima River provides a boundary to the east, the LT Murray Wildlife Area abuts to the north, and the Oak Creek Wildlife Area abuts to the south.

Foot/Hoof Traffic

Horses and hikers will generally stay on road and trail systems which narrows the primary area of impact. Roads and trails will be reviewed for damage and for weed problems and resources will

be allocated to address these issues, including blocking off areas where damage is occurring, placement of cross drains, addition of rock to road/trail surface, spraying of weeds and seeding of disturbed areas.